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A47235

Model RMK 28-A

Serial No. T.45166.

INSTRUCTION MANUAL

KEPCO®

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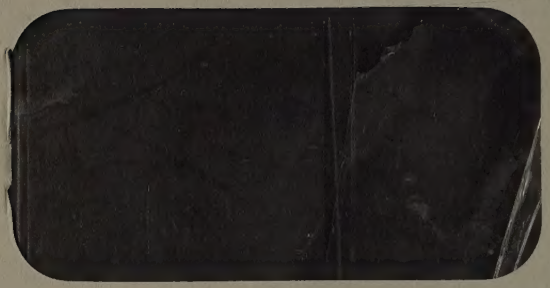

KEPCO

SWITCH-MODE POWER SUPPLIES

RMK

Model RMK 28-A

Serial No. T.45166.

instruction manual

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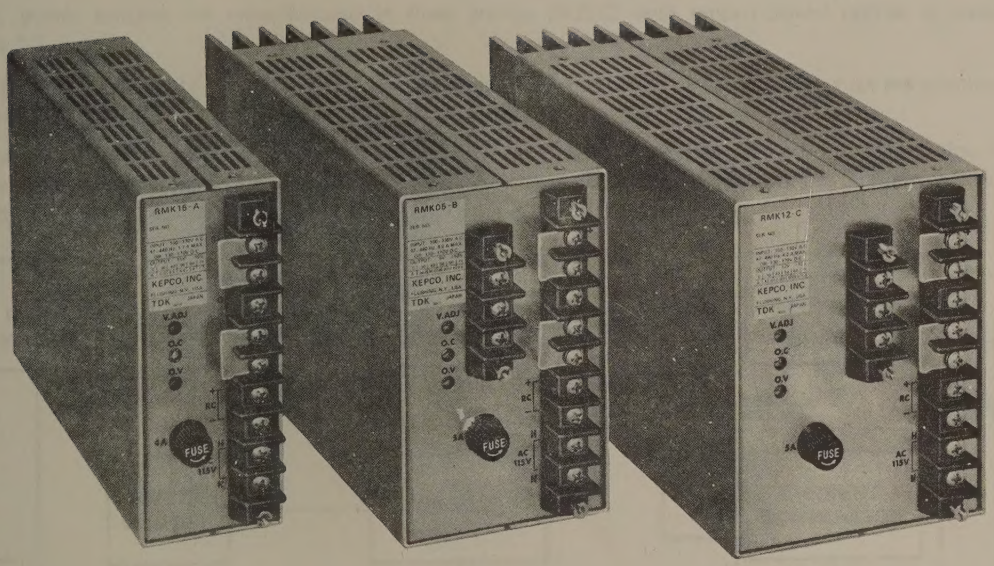
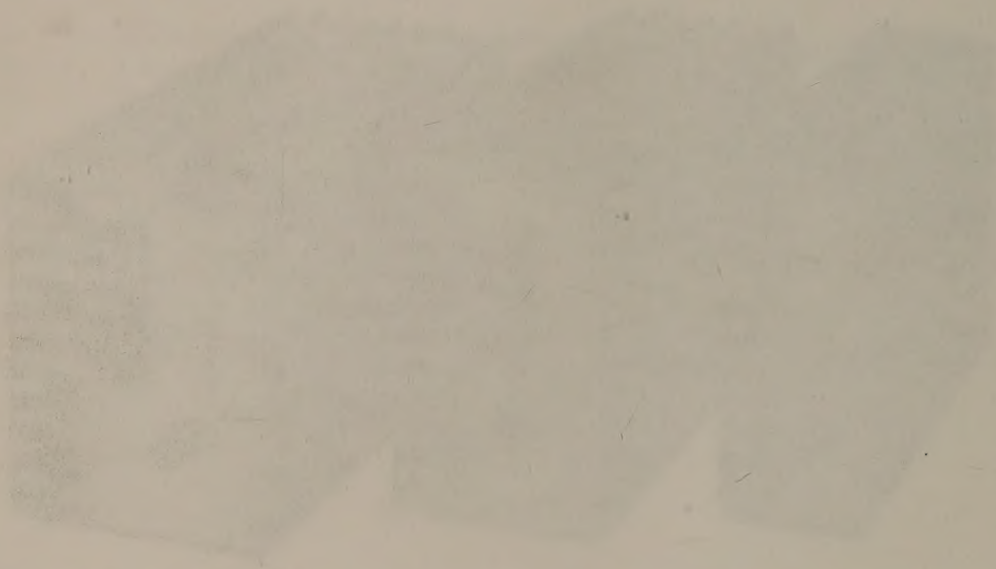


FIG. 1-1 KEPCO RMK SWITCH MODE POWER SUPPLY MODULES.



SECTION I – INTRODUCTION

1-1 SCOPE OF MANUAL

1-2 This manual contains instructions for the installation, operation and maintenance of the KEPCO RMK series of switch-mode stabilized power supply modules.

1-3 GENERAL DESCRIPTION

1-4 The Kepco Series RMK power supplies are general purpose, highly efficient, voltage stabilized d-c sources with adjustable output current limit and overvoltage protection. RMK power supplies are low-dissipative stabilizers using switching devices to control the output power.

1-5 RMK power supplies are manufactured in three groups (A,B,C) with output power ratings as given in Table 1-3.

1-6 The BLOCK DIAGRAM (FIG. 1-2) describes those features of the RMK Power Supply which are common to all models.

The A-C FILTER suppresses the high frequency noise introduced by the source and protects the line from reflected noise generated in the power supply. The A-C LINE RECTIFIER converts the line power into the raw d-c source applied to the POWER STAGE operating in a driven switch mode.

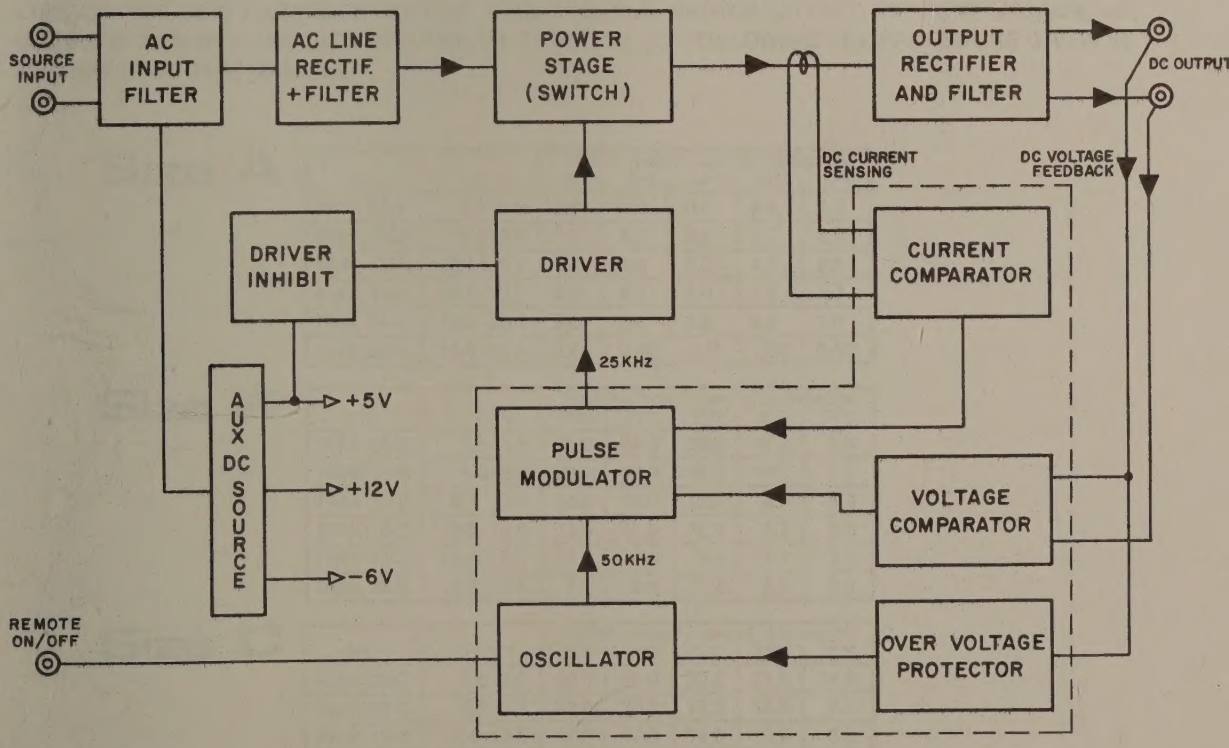


FIG. 1-2 BLOCK DIAGRAM, RMK POWER SUPPLY.

The AUXILIARY D-C SOURCE provides the operating voltages for the control circuits and the DRIVER. The free-running OSCILLATOR produces a non-symmetrical square wave output of approximately 50 KHz. The OSCILLATOR (and therefore the power supply output) can be turned "on" and "off" remotely by means of a TTL logic level change ("on" = high, "off" = low). With the remote terminals open, the power supply is automatically "on". The PULSE-MODULATOR is triggered by the rising edge of the OSCILLATOR output

waveform, thus converting the OSCILLATOR 50 KHz square-wave to the 25 KHz drive pulse. The pulse width of the 25 KHz drive pulse is modulated by the CURRENT and VOLTAGE COMPARATORS according to the feedback signals received via the output current or voltage sensing leads. The modulated signal is applied to the DRIVER stage, which in turn provides the base drive for the POWER STAGE, which prodices the output power via the secondary of the power stage transformer, a full wave rectifier and the 50 KHz output filter. Load protection at the RMK output is provided by the built-in DRIVER INHIBIT, which removes the modulated signal from the DRIVER stage in case of power failure.

1-7 The RMK power supply is constructed in a compact aluminum case (see FIG. 1-3 "Mechanical Outline Dwg." for dimensions and finish). Single board construction provides ready access to all components after cover removal.

1-8 SPECIFICATIONS, ELECTRICAL

A) A-C SOURCE INPUT: 100 to 130V a-c, 47 to 440 Hz, single phase.

B) A-C SOURCE INPUT CURRENT (Approximate maximum value, measured at the nominal output voltage, 100V input voltage, 30°C Load Level per Table 1-1:
RMK–A Group: 2.4A rms
RMK–B Group: 4.6A rms
RMK–C Group: 5A rms

C) D-C SOURCE INPUT VOLTAGE: 130 to 170V

D) D-C SOURCE INPUT CURRENT at 130V input voltage, 30° C Load Level per Table 1-1, (Approximately): RMK–A Group: 0.65A d-c
RMK–B Group: 1.70A d-c
RMK–C Group: 1.85A d-c

E) BROWN OUT VOLTAGES: RMK Model will operate with input voltages as low as 90V a-c, 117V d-c, with minor performance degradation.

F) D-C OUTPUT VOLTAGE AND CURRENT RATINGS: See Table 1-1.

CAUTION

THE OUTPUT CURRENT LIMIT CONTROL (O.C.) ON EACH RMK MODEL IS SET TO APPROXIMATELY 115% OF THE 50°C RATING. IT MAY BE RESET TO THE HIGHER OUTPUT CURRENT VALUES, AS LISTED IN THE 40°C AND 30°C COLUMNS OF TABLE 1-1, BY FOLLOWING THE PROCEDURE GIVEN IN SECTION III OF THIS MANUAL.

Size A

RMK	VOLTS	OUTPUT CURRENT - AMPS VS. TEMPERATURE 30°C	40°C	50°C	60°C	71°C
RMK 05-A	3.5-5.5	12.0	10.8	10.0	8.3	5.0
RMK 09-A	6.3-9.9	7.6	6.8	6.0	5.2	2.7
RMK 12-A	8.4-13.2	6.3	5.6	5.0	4.3	2.0
RMK 15-A	10.5-16.5	5.0	4.5	4.0	3.4	1.7
RMK 24-A	16.8-26.4	3.2	2.8	2.5	2.2	1.0
RMK 28-A	19.6-30.8	2.65	2.40	2.15	1.90	0.90

Size B

RMK	VOLTS	OUTPUT CURRENT - AMPS VS. TEMPERATURE 30°C	40°C	50°C	60°C	71°C
RMK 05-B	3.5-5.5	36.0	34.0	26.0	17.0	9.0
RMK 09-B	6.3-9.9	20.0	17.0	15.0	10.0	5.2
RMK 12-B	8.4-13.2	16.6	15.0	12.0	8.0	4.2
RMK 15-B	10.5-16.5	13.3	13.3	10.2	6.2	3.3
RMK 24-B	16.8-26.4	8.5	8.5	7.5	4.7	2.3
RMK 28-B	19.6-30.8	7.2	6.8	6.4	4.6	2.0

Size C

RMK	VOLTS	OUTPUT CURRENT - AMPS VS. TEMPERATURE 30°C	40°C	50°C	60°C	71°C
RMK 05-C	3.5-5.5	40.0	38.0	30.0	21.5	14.0
RMK 09-C	6.3-9.9	22.0	22.0	17.2	12.5	7.7
RMK 12-C	8.4-13.2	17.0	17.0	14.6	10.5	5.8
RMK 15-C	10.5-16.5	14.0	14.0	12.3	8.3	4.7
RMK 24-C	16.8-26.4	9.0	9.0	8.0	5.5	3.0
RMK 28-C	19.6-30.8	7.7	7.7	6.8	4.7	2.5

TABLE 1-1 D-C OUTPUT RATINGS AT VARIOUS AMBIENT TEMPERATURES, RMK POWER SUPPLIES.

Note: Output Current Values for intermediate ambient temperature values can be linearly interpolated.

1-8 SPECIFICATIONS, ELECTRICAL (Cont'd.)

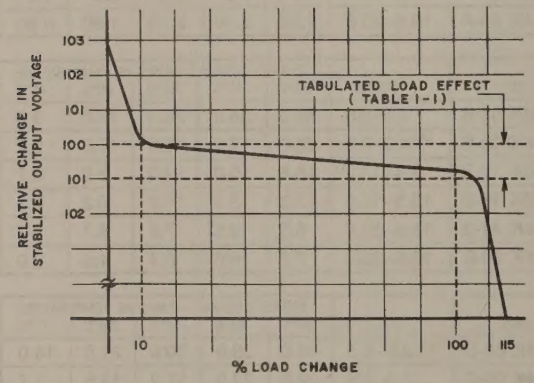
G) OUTPUT EFFECTS: See Table 1-2.

OUTPUT EFFECT	TYP.	MAX.
SOURCE EFFECT:(1)	< 0.3%	0.6%
LOAD EFFECT:(2)	< 0.3%	0.6%
TEMPERATURE EFFECT		
Coefficient per °C:	< 0.02%	0.1%
Envelope 0–50°C:	< 0.4%	0.8%
COMBINED EFFECT: (For rated changes in source voltage, load current and temperature.	< 1.0%	2.0%
TIME EFFECT (8-hour drift) Constant source voltage, load and temperature:	< 0.02%	0.1%
RIPPLE and NOISE		
Rms:	< .5 mV	10 mV
Source component:	< 10 mV	50 mV
Switching component:	< 15 mV	50 mV
Spike component: to 10 MHZ:	< 50 mV	1% E_o +50 mV

TABLE 1-2 OUTPUT EFFECTS, RMK POWER SUPPLIES.

(1) Source effect for input source changes as specified in par. 1-8A and C.

(2) Load effect for 10% to 100% load current change. See graph below for the complete output characteristics of the RMK.



H)

EFFICIENCY:	RMK–A	RMK–B	RMK–C
TYPICAL:	68%	75%	75%
MINIMUM:	65%	70%	70%

I) AMBIENT OPERATING TEMPERATURE RANGE: 0 to 71°C (See Table 1-1). Ratings based on a maximum heat sink temperature of 80°C.

J) STORAGE TEMPERATURE: (-)50°C to (+)85°C.

K) TRANSIENT RECOVERY: A step-load change of 50 to 100% produces less than 2% or 0.5 Volts, whichever is greater, output voltage excursion and recovers to within 0.5% (or 0.05 volts, whichever is greater) of the original output voltage setting in less than 1 millisecond.

L) HOLDING TIME CARRY-OVER): Full load output is sustained within the load effect band for a minimum of 20 milliseconds, 30 milliseconds typically, following loss of a-c input source power. Note: Specification is based on operation on 115V a-c source voltage and the 50°C loading level per Table 1-1.

1-9 MISCELLANEOUS FEATURES:

A) SOFT START: Soft start circuit provided on all RMK models, to limit a-c line surge current at the initial turn-on.

B) REMOTE ON/OFF CONTROL: Following initial source turn-on, all RMK models may be turned on and off by means of a TTL logic level, turn-on = high (2-5V), turn-off = low (0—0.4V, I sink = 3mA max.). The logic level is normally set high (RMK "on") by means of a pull-up resistor. Separate rear terminals are provided for this function.

C) PROTECTIVE FEATURES:

1) A-C INPUT PROTECTION: A-C line fuse in extractor post on the rear of all RMK models (see Parts List).

2) DRIVER INHIBIT CIRCUIT: Turns off driver circuit when a-c input fails.

3) OVERVOLTAGE PROTECTION CIRCUIT: Turns oscillator circuit off and reduces power supply output to zero. Reset by turning a-c source power "off" (for approx. 20 seconds on RMK-B and RMK C models, 5 seconds on RMK-A models to allow input filter to discharge) and then "on" again. Screwdriver adjustable, factory set to 120% above nominal output voltage.

4) CURRENT LIMIT: Screwdriver adjustable to 115% of the 30°C, 40°C and 50°C load current values listed in Table 1-1 for each model. Factory set to 115% of the 50°C current value.

D) OUTPUT VOLTAGE ADJUSTMENT: Output voltage screwdriver adjustable +10 -30% around the nominal rated value (see Table 1-1).

E) ELECTROMAGNETIC INTEREFERENCE (E.M.I.): Filters are built-in to reduce the conducted EMI (harmonics of the 25 KHz switching frequency) to levels that are acceptable for most applications. Accessory filters may be used between RMK and the source power line to reduce EMI Levels further, Kepco Model FLT—3A, suitable for all RMK—A models, will attenuate the conducted EMI a minimum of 60 dB in the frequency range from 0.15 to 30 MHz. Model FLT—10A, suitable for all RMK—B and RMK—C models, will attenuate the conducted EMI a minimum of 40 dB in the frequency range from 0.7 to 30 MHz.

F) SHOCK AND VIBRATION: SHOCK: 2G, 3 axes. VIBRATION: 2G, 5 Hz to 55 Hz. Amplitude: 10mm.

G) ISOLATION at 20° C, 65% RELATIVE HUMIDITY: between input and output terminals or case: 1.5 kV a-c for 1 minute.

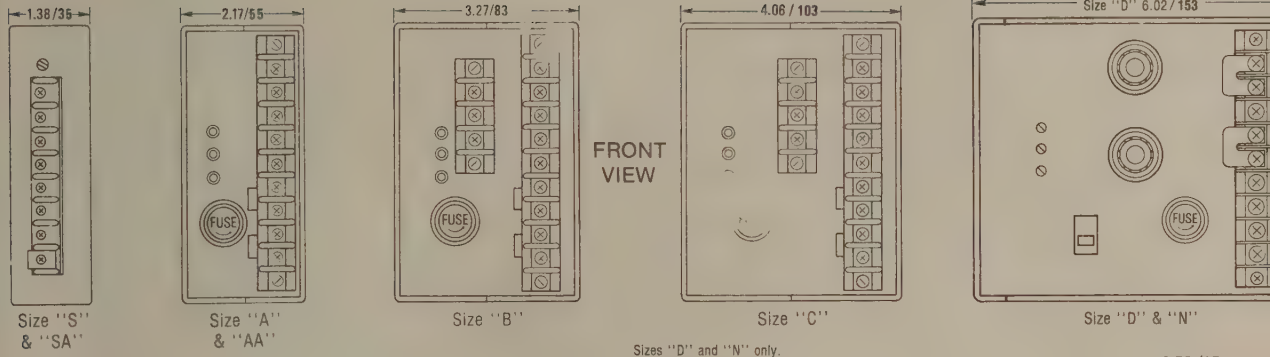
H) ISOLATION at 20° C, 65% RELATIVE HUMIDITY: between output terminals and case: 500V d-c, 100 megohms minimum.

I) SERIES/PARALLEL: RMK power supplies may be connected in series for greater voltage output (up to 500V maximum) and in parallel, for increased current output (see Section III).

1-10 MECHANICAL SPECIFICATIONS:

A) DIMENSIONS AND FINISH : Refer to FIG. 1-3 "Mechanical Outline Drawing".

B) WEIGHT: RMK—A Group: 3.1 lbs. (1.4 kg)
RMK—B Group: 5.1 lbs (2.3 kg)
RMK—C Group: 5.5 lbs (2.5 kg)



OUTLINE DIMENSIONAL DRAWINGS

Decimal dimensions in light face type are in inches
dimensions in bold face type are in millimeters.
Tolerance: ± 0.016" **(0.4)** between mounting holes.
± 0.032" **(0.8)** other dimensions.

DIMENSIONS

MODEL	R	S	T	U	V	W	X	Y	Z
Size "S"	1.38 **35**	0.39 **10**	3.86 **98**	5.75 **146**	—	0.63 **16**	0.59 **15**	3.86 **98**	0.49 **12.5**
Size "SA"	1.38 **35**	0.39 **10**	3.86 **98**	5.75 **146**	6.97 **177**	0.63 **16**	0.59 **15**	3.86 **98**	0.49 **12.5**
Size "A"	2.17 **55**	0.87 **22**	5.91 **150**	7.52 **191**	—	0.79 **20**	0.28 **7**	6.69 **170**	0.65 **16.5**
Size "AA"	2.17 **55**	0.87 **22**	5.91 **150**	7.52 **191**	8.82 **224**	0.79 **20**	0.28 **7**	6.69 **170**	0.65 **16.5**
Size "B"	3.27 **83**	1.97 **50**	5.91 **150**	7.52 **191**	8.82 **224**	0.79 **20**	0.28 **7**	6.69 **170**	0.65 **16.5**
Size "C"	4.06 **103**	2.76 **70**	5.91 **150**	7.52 **191**	8.82 **224**	0.79 **20**	0.28 **7**	6.69 **170**	0.65 **16.5**
Size "D"	6.02 **153**	4.53 **115**	5.91 **150**	7.52 **191**	8.82 **224**	0.79 **20**	0.28 **7**	6.69 **170**	0.75 **19**
Size "N"	5.24 **133**	3.74 **95**	5.91 **150**	7.52 **191**	8.82 **224**	0.79 **20**	0.28 **7**	6.69 **170**	0.75 **19**

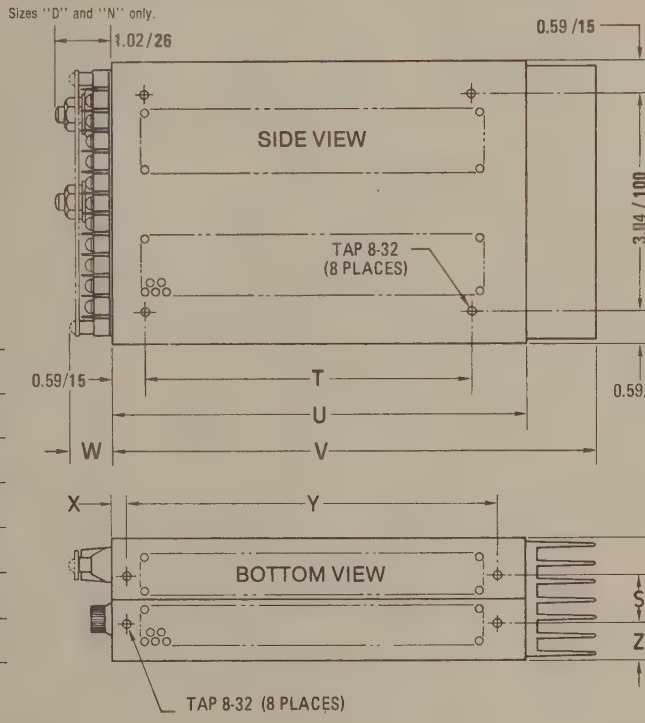


FIG. 1-3 MECHANICAL OUTLINE DRAWING.

SECTION II – INSTALLATION

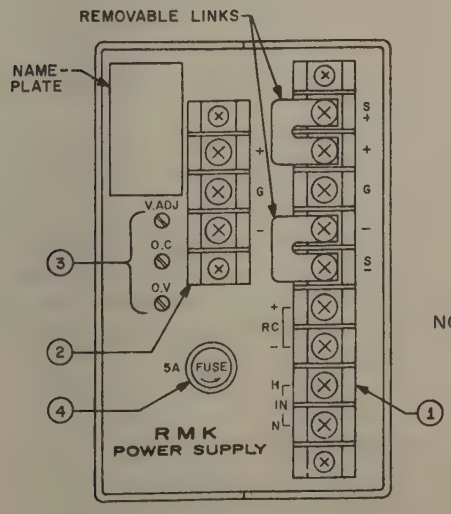
2-1 UNPACKING AND INSPECTION

2-2 This instrument has been thoroughly inspected and tested prior to packing and is ready for operation. Perform the preliminary operational check as outlined in paragraph 2-8. If any indication of damage is found, file an immediate claim with the responsible transport service.

2-3 TERMINATIONS: See FIG. 2-1 and Table 2-1.

NO.	TERMINATION	FUNCTION
1	9-TERMINALS BARRIER STRIP	–, +, =D-C OUTPUT TERMINALS S+, S– =SENSING TERMINALS G =CHASSIS CONNECTION: Return to A-C GROUND! +, RC, – =REMOTE TURN-ON/TURN-OFF TERMINALS IN (H–N) =A-C or D-C INPUT TERMINALS
2	3-TERMINALS BARRIER STRIP (ON RMK GROUPS B AND C ONLY)	–, +, D-C OUTPUT TERMINALS G =CHASSIS CONNECTION
3	INTERNAL CONTROLS (RECESSED, SCREWDRIVER ADJUSTABLE)	V.ADJ. =OUTPUT VOLTAGE ADJUSTMENT O.C. =CURRENT LIMIT ADJUSTMENT O.V. =OVERVOLTAGE ADJUSTMENT
4	FUSE	INPUT CIRCUIT PROTECTION: GROUP A RMK MODELS: 4 A (See Parts List) GROUP B and C RMK MODELS: 5 A (See Parts List)

TABLE 2-1 TERMINATIONS, KEPCO RMK POWER SUPPLIES.



NOTE: ON ALL RMK UNITS, D-C INPUT VOLTAGE MAY BE APPLIED TO "IN" TERMINALS "H" AND "N" WITHOUT REGARD TO POLARITY.

FIG. 2-1 TERMINATIONS, KEPCO RMK POWER SUPPLIES.

2-4 SOURCE POWER REQUIREMENTS

Refer to Section I, par. 1-8.

2-5 SOURCE POWER TURN-ON/TURN-OFF

2-6 Source input power to the RMK power supply is applied in the conventional manner by means of an external power switch, in series with one or both of the source input terminals, (see FIG. 2-2).

2-7 Following source turn-on, for systems applications, the RMK power supply can be remotely programmed "on" and "of" by means of a contact closure, or TTL logic levels. This permits turn-on/off sequencing and avoids a-c surge currents associated with conventional a-c power turn-on/off cycles. In FIG. 2-2, both, the conventional and the remote a-c power turn-on/turn-off methods are shown:

A) If remote turn-on/off is not needed, delete components connected to terminals +RC, −RC and leave these terminals open.

B) If the remote control method is used, retain the SOURCE POWER switch, NOTE: Source power turn-on/turn-off must be retained since the overvoltage protector circuit is re-activated, following an overvoltage condition, by removing (5 seconds minimum) and re-applying the source power. Either the indicated switch (S1) or TTL levels may be used for remote control as indicated in the table of FIG. 2-2. The switch (S1) must be "chatter-free", ***or*** the indicated components should be used to integrate the switching pulse.

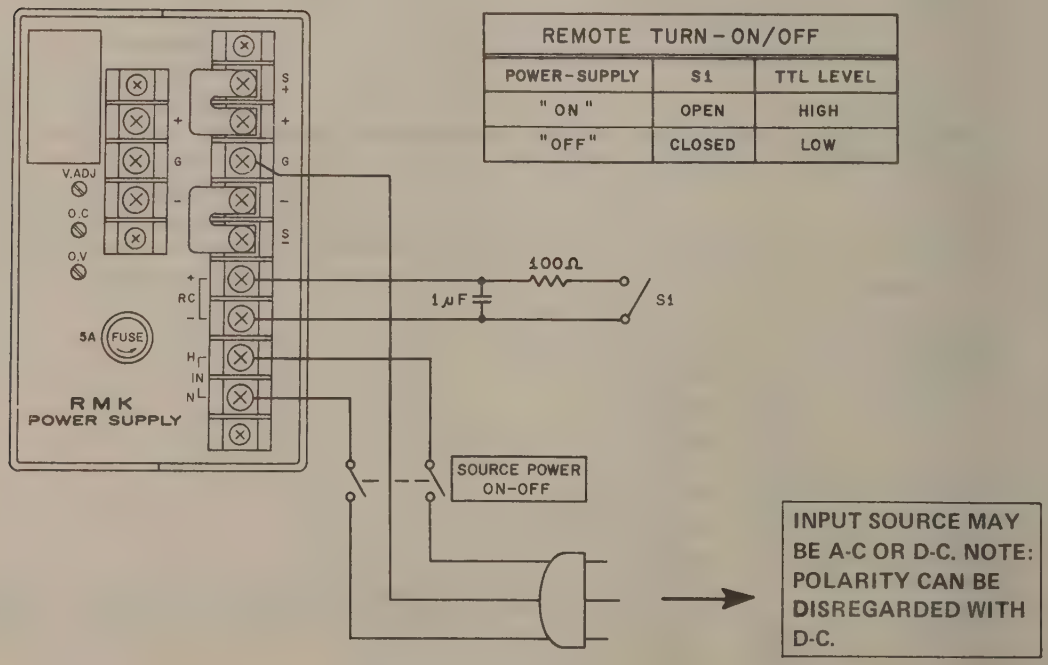


FIG. 2-2 CONVENTIONAL AND REMOTE SOURCE POWER TURN-ON/TURN-OFF.

Note: Remote turn-on/off circuit may be deleted.

2-8 PRELIMINARY CHECK-OUT

2-9 A simple operating check after unpacking and before permanent installation is advisable to ascertain whether the power supply has suffered damage resulting from shipment. Refer to FIG. 2-3 for the location of the output terminals. Connect output metering and load as shown.

a) Connect power supply to 115V a-c source. Use either turn-on/turn-off method as described in PAR. 2-5 through 2-7.

b) Turn the RMK power supply "on", and observe the output voltage meters (M1, M2) for the rated nominal output voltage and current of the RMK model under test.

c) Check the current limit point by ***reducing*** the load resistance until the output voltage starts to decrease, as observed on M1. The output current value, as observed on M2, should be approximately 115% of the rated nominal output current value (as listed in 50°C column of Table 1-1, Section I) for the RMK power supply under test. This concludes the preliminary check-out.

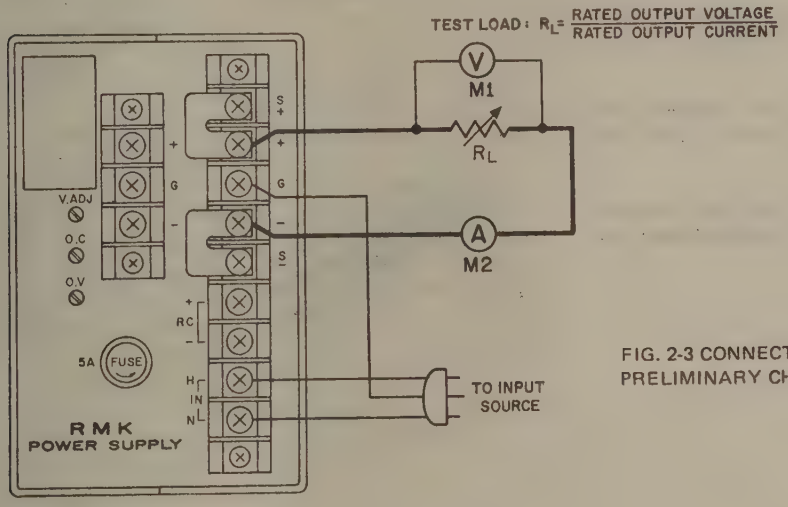


FIG. 2-3 CONNECTIONS FOR THE PRELIMINARY CHECK-OUT.

2-10 INSTALLATION AND COOLING REQUIREMENTS

2-11 GENERAL. RMK power supplies may be operated in ambient temperatures from 0 to 71°C, without forced air cooling and with the output currents as listed in Section I, Table 1-1, when mounted as described in the following paragraphs.

CAUTION

ALL RMK POWER SUPPLY OUTPUT CURRENT RATINGS ARE BOUND BY A MAXIMUM AVERAGE HEAT SINK TEMPERATURE OF 80°C AND BY THE MAXIMUM OUTPUT CURRENT OF EACH MODEL, AS LISTED IN THE 30°C COLUMN OF TABLE 1-1, SECTION I.

IF A RELIABLE MEANS OF DETERMINING THE HEAT SINK TEMPERATURE IS AVAILABLE, RMK POWER SUPPLIES MAY BE MOUNTED IN ANY POSITION AND MAY BE OPERATED AT THEIR MAXIMUM CURRENT (AS LISTED IN THE 30° COLUMN OF TABLE 1-1, SECTION I) AS LONG AS THE MEASURED AVERAGE HEAT SINK TEMPERATURE DOES NOT EXCEED 80°C. IF NECESSARY, FORCED AIR FLOW CAN BE PROVIDED TO KEEP THE HEAT SINK TEMPERATURE AT OR BELOW 80°C FOR ADDITIONAL PROTECTION, A THERMALLY ACTUATED SWITCH CAN BE MOUNTED ONTO THE HEAT SINK, WITH ITS "NORMALLY OPEN" CONTACTS WIRED ACROSS THE POWER SUPPLY'S "RC" TERMINALS. IN THE EVENT OF AN OVER-TEMPERATURE CONDITION, THE "RC" TERMINALS WILL BE SHORTED AND THEREBY INHIBIT ALL OUTPUT FROM THE RMK POWER SUPPLY, AS LONG AS THE OVER-TEMPERATURE CONDITION PERSISTS.

2-12 MOUNTING WITHOUT FORCED AIR COOLING, GROUP "A" MODELS. RMK models in Group A may be mounted, with or without the (optional) heat sinks, in the two positions shown in FIG's 2-4 and 2-5 respectively. If mounted in the horizontal position, as shown in FIG. 2-4, the heat sink (Kepco Model FIN–AS) can be used, while when mounted in the vertical position (as shown in FIG. 2-4), the heat sink (Kepco Model FIN–AL) may be installed. Both heat sinks will improve the current capacity vs. temperature as noted in FIG's 2-4 and 2-5.

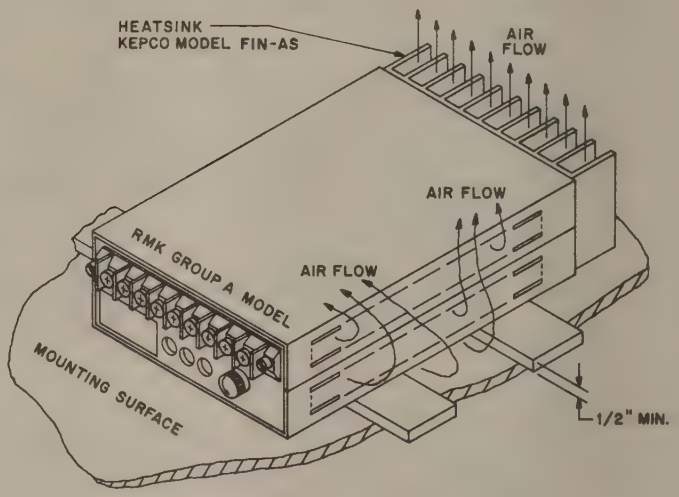


FIG. 2-4 RECOMMENDED MOUNTING METHOD (HORIZONTAL) FOR RMK GROUP A POWER SUPPLIES

Output current rating *with heat sink:* Determine ambient temperature, *subtract 10°C* and use Table 1-1 in Section I.

Output current rating *without heat sink:* Determine ambient temperature, *add 10°C* and use Table 1-1 in Section I.

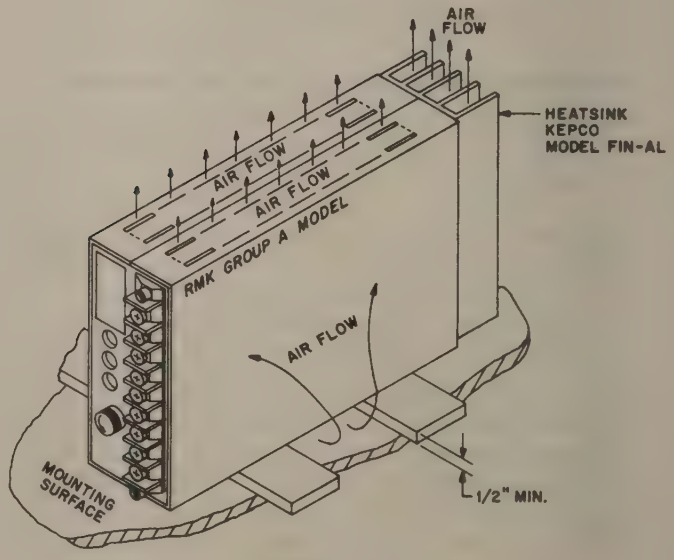


FIG. 2-5 RECOMMENDED MOUNTING METHOD (VERTICAL) FOR RMK GROUP A POWER SUPPLIES

Output current rating *with heat sink:* Determine ambient temperature, *subtract 10°C* and use Table 1-1 in Section I.

Output current rating *without heat sink:* Determine ambient temperatue and use Table 1-1 in Section I.

2-13 MOUNTING WITHOUT FORCED AIR COOLING, GROUP "B" and "C" MODELS. RMK models in Group B or C may be mounted in the two positions shown in FIG's. 2-6 and 2-7 respectively. If mounted in the horizontal position as shown in FIG. 2-6, the standard heat sink, whose cooling fins are now oriented horizontally, will not be quite as efficient as in the vertical position. The standard heat sink can, however, be replaced by the (optional) heat sink, Kepco Model FIN–BS (Group B) or Model FIN–CS (Group C), which reorients the cooling fins into the vertical position.

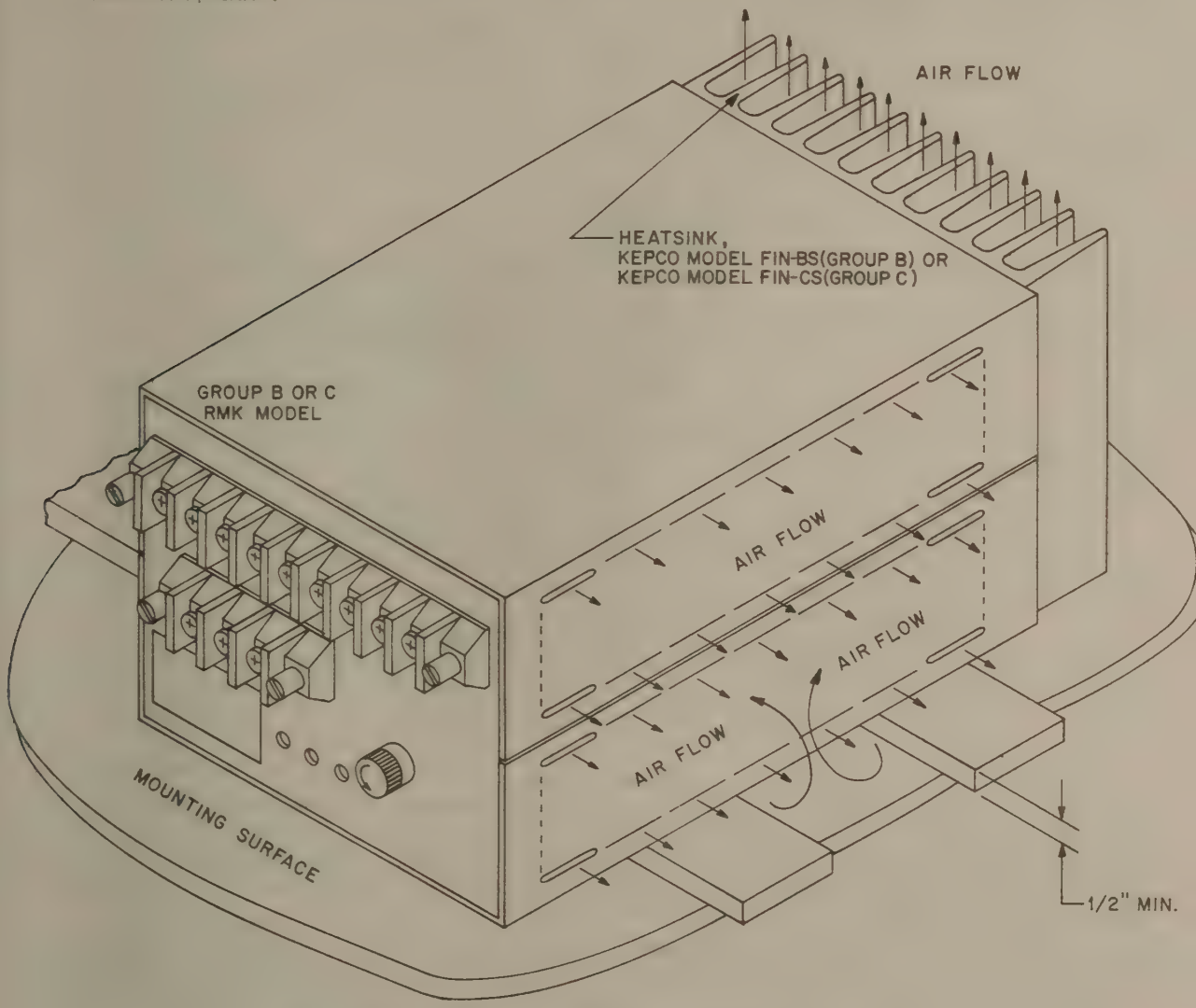


FIG. 2-6 RECOMMENDED MOUNTING METHOD (HORIZONTAL) FOR GROUP B AND C RMK POWER SUPPLIES WITH OPTIONAL HEAT SINK.

Output current rating *with optional heat sink:* Determine ambient temperature and use Table 1-1 in Section I.

Output current rating with *standard heat sink:* Determine ambient temperature, add 10°C and use Table 1-1, Section I.

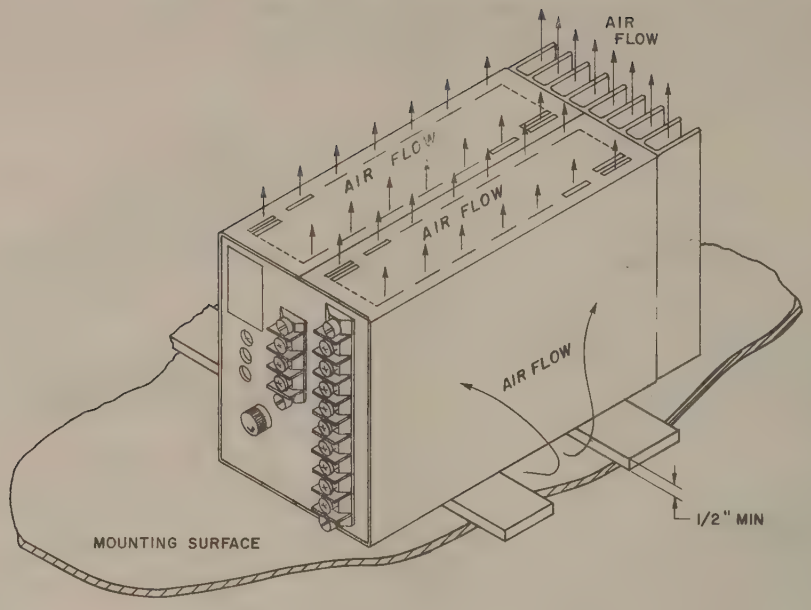


FIG. 2-7 RECOMMENDED MOUNTING METHOD (VERTICAL) FOR RMK GROUP B AND C POWER SUPPLIES (CONVECTION COOLING), WITH STANDARD HEAT SINK.

Output current rating:
Determine ambient temperature and use Table 1-1, Section I.

CAUTION

ALL RMK POWER SUPPLY OUTPUT CURRENT RATINGS ARE BOUND BY A MAXIMUM AVERAGE HEAT SINK TEMPERATURE OF 80°C AND BY THE MAXIMUM OUTPUT CURRENT OF EACH MODEL, AS LISTED IN THE 30°C COLUMN OF TABLE 1-1, SECTION I.

IF A RELIABLE MEANS OF DETERMINING THE HEAT SINK TEMPERATURE IS AVAILABLE, RMK POWER SUPPLIES MAY BE MOUNTED IN ANY POSITION AND MAY BE OPERATED AT THEIR MAXIMUM CURRENT (AS LISTED IN THE 30° COLUMN OF TABLE 1-1, SECTION I) AS LONG AS THE MEASURED AVERAGE HEAT SINK TEMPERATURE DOES NOT EXCEED 80°C. IF NECESSARY, FORCED AIR FLOW CAN BE PROVIDED TO KEEP THE HEAT SINK TEMPERATURE AT OR BELOW 80°C. FOR ADDITIONAL PROTECTION, A THERMALLY ACTUATED SWITCH CAN BE MOUNTED ONTO THE HEAT SINK, WITH ITS "NORMALLY OPEN" CONTACTS WIRED ACROSS THE POWER SUPPLY'S "RC" TERMINALS. IN THE EVENT OF AN OVER-TEMPERATURE CONDITION, THE "RC" TERMINALS WILL BE SHORTED AND THEREBY INHIBIT ALL OUTPUT FROM THE RMK POWER SUPPLY, AS LONG AS THE OVER-TEMPERATURE CONDITION PERSISTS.

SECTION III — OPERATION

3-1 GENERAL

3-2 Interconnection between an a-c power source and a stabilized power supply, and between the power supply and its load are as critical as the interface between any other electronic equipment. If optimum performance is expected, certain rules for the interconnection of source, power supply and load must be observed by the user. These rules are described in detail in the following paragraphs.

3-3 SAFETY GROUNDING

3-4 National and international safety rules dictate the grounding of the metal cover and case of any instrument connected to the a-c power source.

WARNING

KEEP INSTRUMENT GROUNDED WHILE IT IS CONNECTED TO THE A-C POWER SOURCE

3-5 The recommended a-c power connections to RMK power supplies by means of a three-wire a-c line cord with grounding plug are illustrated in all diagrams in this section (Section III).

3-6 SIGNAL GROUNDING

3-7 Connections between the power supply and the load (load and sensing connections), will invariably, despite all precautions such as shielding, twisting of wire-pairs, etc., "pick-up" radiated noise of a wide frequency spectrum. To minimize this undesired output, a SIGNAL GROUND is needed. The signal ground consists of a single ground point, either at one of the power supply output terminals or at one side of the load.

3-8 Kepco has provided an internal signal ground on all models in the RMK series, consisting of a capacitor from both d-c output terminals to the chassis. If, therefore, the chassis of the RMK is a-c safety grounded by means of its three-prong plug, the safety, as well as the signal ground is automatically established.

3-9 The signal ground provided internally in the RMK is sufficient for performance within specifications for most applications with an isolated load. If the load has its own ground, however, or high ripple is observed during operation, an additional filter capacitor may be required directly across the load terminals.

3-10 POWER SUPPLY/LOAD INTERFACE

3-11 The general function of a voltage or current stabilized power supply is to deliver the rated output quantities to the connected load. The load (or loads) may have any conceivable characteristic. It may be fixed or variable, it may have predominantly resistive, capacitive, or inductive parameters, and it may be located very close to the power supply, or it may be a considerable distance away. The power supply designer cannot anticipate every conceivable application, location or nature of the load. He must design his product for the widest possible application range and specify the performance at the output terminals of the power supply. The aim of the following paragraphs is to aid the user in the final use of the product, the interface of the power supply and the load.

3-12 The perfect interface between a power source and its load would mean that the specified performance at the output terminals would be transferred without impairment to any load, regardless of its characteristics, distance from the power supply or environment. To approach this ideal, the power supply must satisfy certain requirements. Interconnecting rules must be closely followed and Ohm's Law, as well as basic a-c theory must be considered in selecting the interface wiring.

3-13 The stabilized d-c power supply is definitely not an ideal voltage or current source with zero output impedance (VOLTAGE MODE) at all frequencies. All voltage sources have some amount of impedance which increases with frequency. (Refer to FIG. 3-1.) A more realistic model for a voltage stabilized power supply must, for example, include a series resistance, representing the small d-c and low frequency source impedance, in series with an inductance, representing the source impedance at higher frequencies.

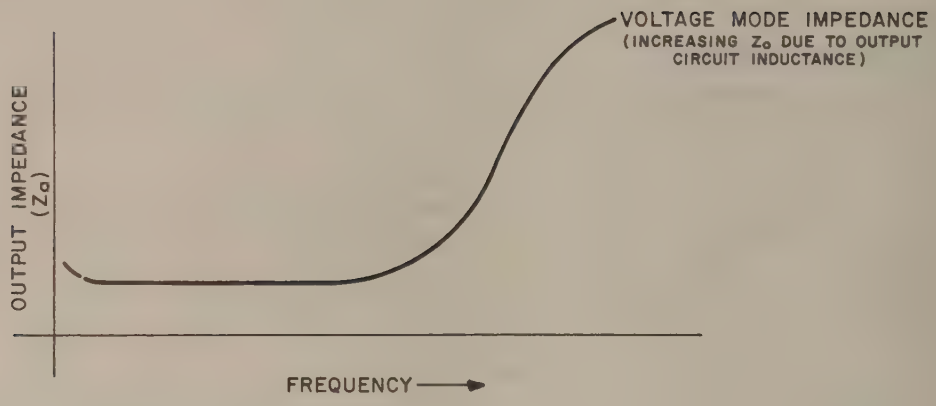


FIG. 3-1 TYPICAL OUTPUT IMPEDANCE VS. FREQUENCY PLOT FOR STABILIZED D-C VOLTAGE SOURCES.

3-14 LOAD WIRE SELECTION

3-15 Load wire selection should proceed considering the facts discussed in PAR's 3-10 to 3-14. The load wire size should be selected for minimum voltage drop, and the series inductance of the load wire must be kept as small as possible compared to the output impedance of the power supply. These considerations are especially important if:

1) The load is constantly changing in value.

2) The load is switched "on" and "off".

3) The load has a primarily reactive characteristic.

4) The dynamic output response of the power supply is considered important.

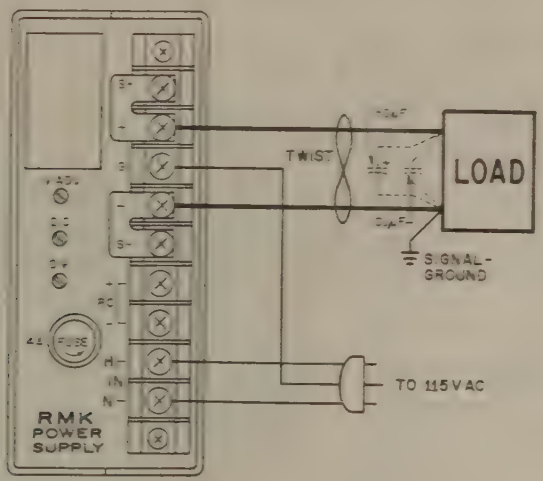
IN PRACTICAL TERMS, THE LOAD WIRE SHOULD ALWAYS BE AS HEAVY AND AS SHORT AS POSSIBLE.

In spite of all precautions taken in interconnecting the power supply and the load, and in spite of the low ESR electrolytics and high frequency bypass capacitors used in the output of the RMK power supply, the power supply/load connection wires may "pick-up" high frequency switching noise.

An effective solution to the pick-up problem is to locate an external shunt filter directly at the load, as indicated in all connection diagrams in this section. The filter consists of a low/high frequency bypass capacitor (C1 = 50μF electrolytic, C2 = 0.1μF polyester film, with working voltages according to power supply output voltage). The given values have been used successfully for most applications.

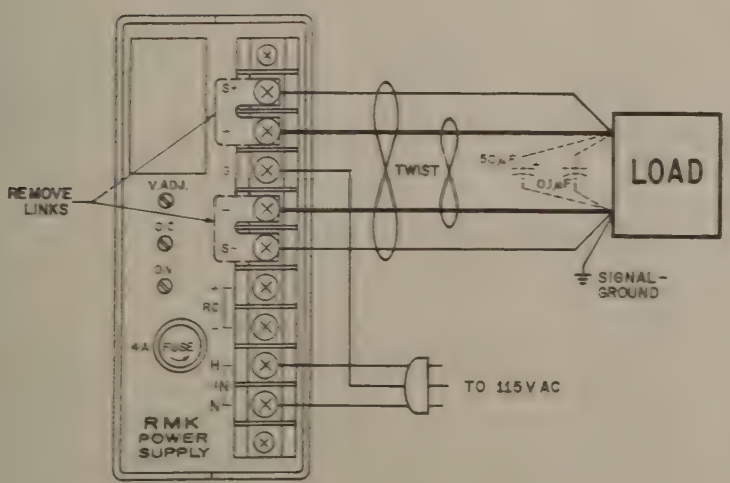
3-16 LOAD CONNECTIONS

3-17 The load may be connected in one of the ways illustrated in FIG.'s 3-2 through 3-5. IMPORTANT NOTE: IF ERROR SENSING IS USED, THE SHORTING LINKS BETWEEN OUTPUT AND SENSING TERMINALS MUST BE COMPLETELY REMOVED. IF ERROR SENSING IS NOT USED, THE LINKS MUST BE CONNECTED AT THE BARRIER STRIP. TIGHTEN BARRIER STRIP TERMINAL SCREWS SECURELY. LOOSE CONNECTIONS MAY CAUSE MALFUNCTIONING OF THE POWER SUPPLY.



NOTE: An additional filter may be required at the load as shown. See PAR.'s 3-14, 3-15.

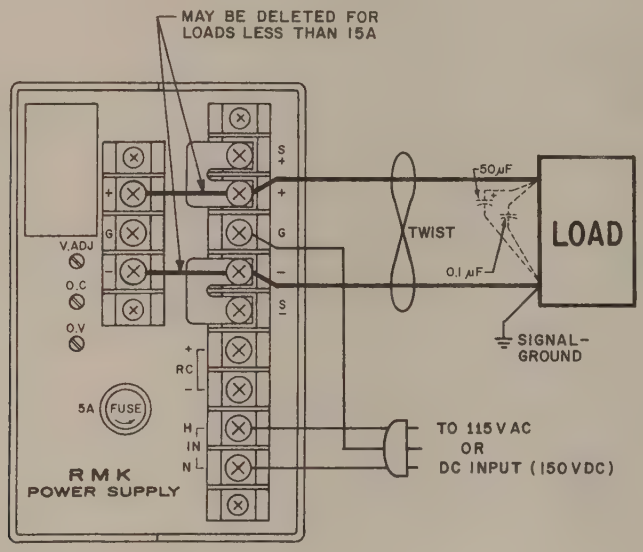
FIG. 3-2 LOAD CONNECTIONS *WITHOUT* ERROR SENSING, RMK GROUP A.



NOTE: An additional filter may be required at the load as shown. See PAR.'s 3-14, 3-15.

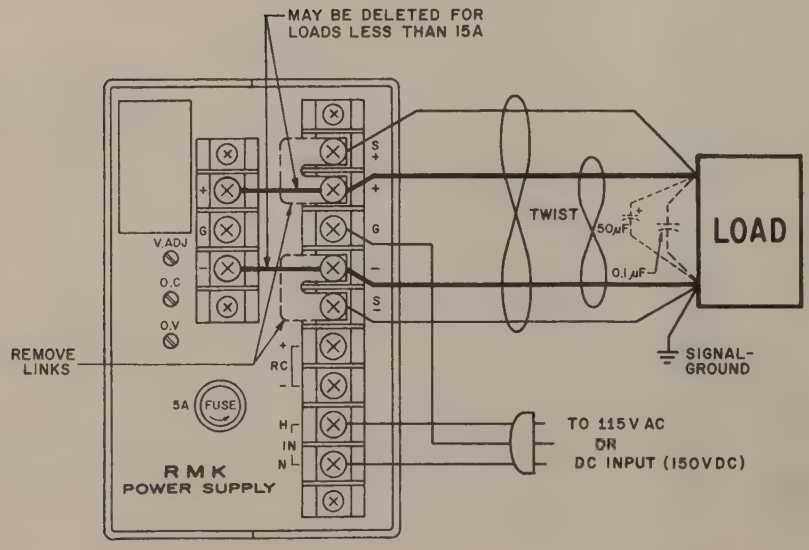
FIG. 3-3 LOAD CONNECTIONS *WITH* ERROR SENSING, RMK GROUP A.

3-18 RMK Group B and C models have an auxiliary barrier strip with an additional (±) output terminal pair, plus ground terminal. These terminals are in parallel with those on the main barrier strip and have been provided for load current distribution in cases where the load current is greater than 15 amperes. In these cases the second terminal pair may be used to carry the excess load current, thus reducing terminal load and load wire size.



NOTE: An additional filter may be required at the load as shown. See PAR.'s 3-14, 3-15.

FIG. 3-4 LOAD CONNECTIONS *WITHOUT* ERROR SENSING, FOR LOAD CURRENT IN EXCESS OF 15A D-C, RMK GROUPS B AND C.



NOTE: An additional filter may be required at the load as shown. See PAR.'s 3-14, 3-15.

FIG. 3-5 LOAD CONNECTIONS *WITH* ERROR SENSING, FOR LOAD CURRENT IN EXCESS OF 15A D-C, RMK GROUPS B AND C.

3-19 SERIES OPERATION OF RMK POWER SUPPLIES

3-20 KEPCO RMK power supplies can be series-connected for increased output voltage, provided the specified limits on voltage to chassis are not exceeded.

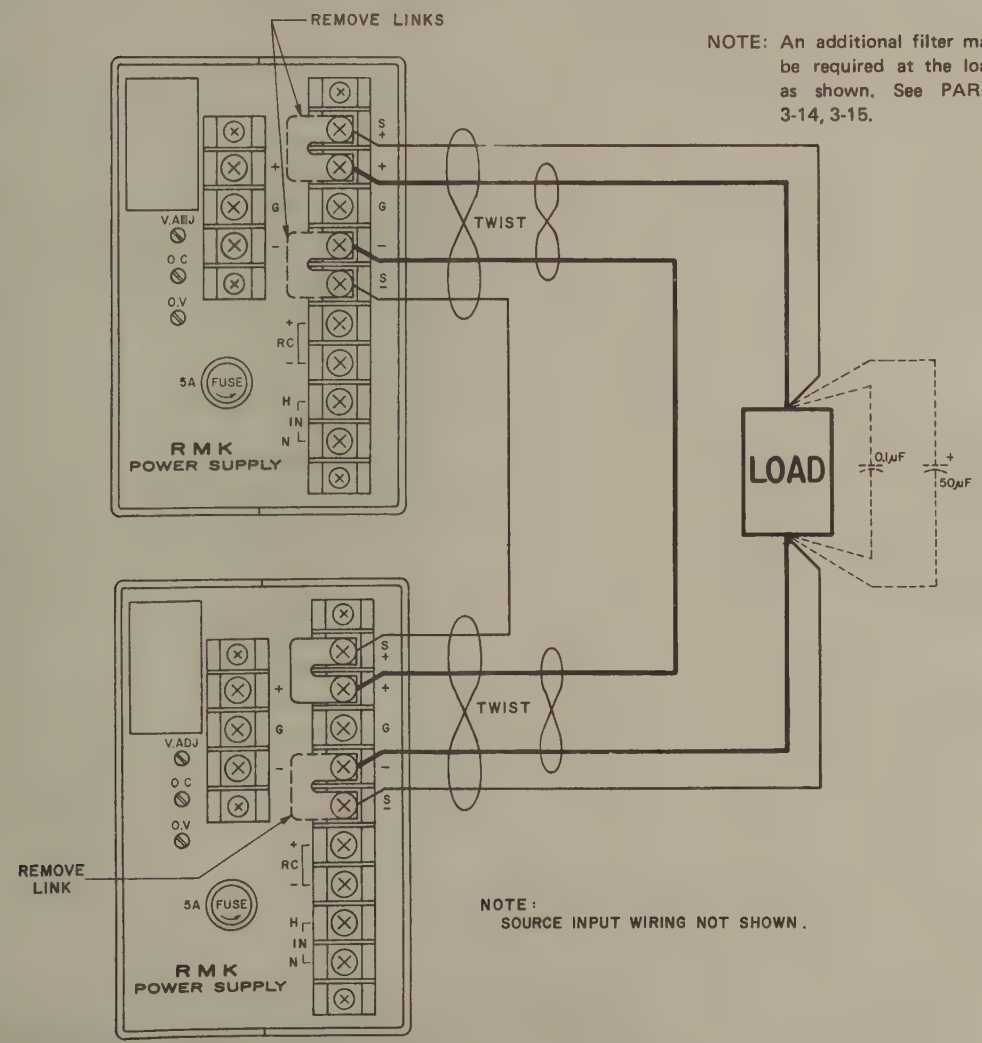


FIG. 3-6 SERIES CONNECTION OF RMK POWER SUPPLIES, WITH ERROR SENSING AT THE COMMON LOAD.

3-21 PROCEDURE (Refer to FIG. 3-6):

a) Connect supplies and load as shown in FIG. 3-6. Keep voltage drop in load wires as low as possible by using proper gauge wire.

b) Remove jumpers as shown and connect error sensing leads to load. Use at least #20 gauge wire for error sensing leads. Twist all lead pairs.

c) Turn supplies "on" and adjust output voltage on either or both V.ADJ controls as required.

3-22 PARALLEL OPERATION OF RMK POWER SUPPLIES

3-23 When two RMK power supplies operate into a load demanding more output current than one of them can deliver, one of them will always be at a slightly higher output voltage level than the other, in spite of any attempt to equalize the output voltage before connecting the load. The supply with the higher output voltage (Supply #1) will therefore attempt to deliver all the output current, but will only be able to supply current up to its current limit setting and will then transfer into the current limit mode. The other supply (Supply #2) will now take over and deliver the balance of the output current, while operating in the "voltage mode".

NOTE: The following example describes the parallel operation of two (2) Model RMK 05–C, for a total output current of 60 amperes, with an operating voltage of 5 volts at the load and a total lead wire voltage drop of 0.4 volts. The expected ambient temperature is 40°C.

A) LOAD POWER REQUIRED: 5V x 60 A = 300 WATT

B) LOAD WIRE POWER LOSS: 0.4V x 60 A = 24 WATT

TOTAL POWER = 324 WATT

C) ONE RMK 05–C MUST SUPPLY: 324/2 - 162 WATT AT 40°C.

D) A CHECK WITH THE RATING TABLE (SECTION I, TABLE 1-1) SHOWS THAT THIS IS WITHIN THE SAFE OPERATING REGION OF THE RMK 05–C (TABLE VALUE @ 40°C = 5V x 38A = 190W).

3-24 PROCEDURE, PARALLEL CONNECTION OF TWO RMK POWER SUPPLIES

Set operating controls on ***each*** RMK as follows:

1) V.ADJ. control: 5.1 Volt.
2) O.C. control: Leave at factory setting (34.5A = 115% of rated current).
3) O.V. control: Turn maximum clockwise.

STEP 1) Connect RMK power supplies, instrumentation and load, as shown in FIG. 3-7.

STEP 2) Turn power supply system "on" and monitor load voltage and current as indicated in FIG. 3-7.

STEP 3) With a suitable screwdriver, slowly turn V.ADJ. control of Supply #1 counterclockwise until 5.00 volts is read out on M1.

STEP 4) Turn V.ADJ. control of Supply #2 slowly counterclockwise until it takes control from Supply #1 as indicated by the changing voltmeter reading on M1. Turn V.ADJ. to approximately 4.90 volts and then slowly approach 5.00 volts until Supply #2 reaches 5.00 volts. This concludes the adjustment.

Note: Careful adjustment of the output voltage of the two supplies will result in equal current sharing and yield load effects close to that of a single unit. A carefully adjusted system should yield output voltage changes for full load to no load of approximately 60 mV.

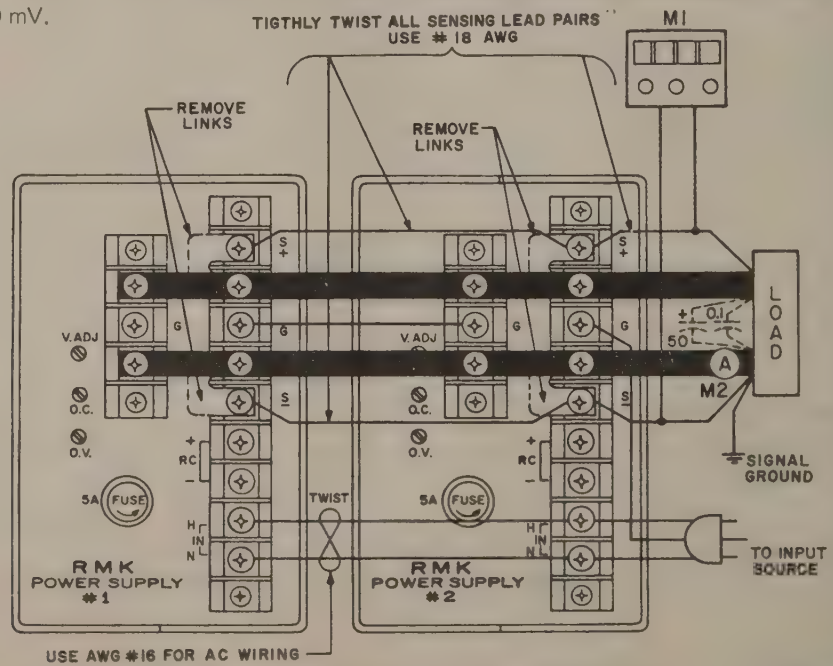


FIG. 3-7 PARALLEL CONNECTION OF TWO RMK POWER SUPPLIES.

3-25 MULTIPLE PARALLEL CONNECTION OF RMK POWER SUPPLIES

3-26 The previously discussed concepts for paralleling RMK modules (PAR.'s 3-22 through 3-24) can be extended to include more than two power supplies, the practical limit being dictated by the larger and larger wire size required. The following parameters must be determined before each system's application involving multiple parallel connection of RMK Power Supplies.

1) REQUIRED LOAD VOLTAGE AND CURRENT
2) ANTICIPATED MAXIMUM AMBIENT TEMPERATURE
3) LOAD WIRE VOLTAGE DROP FROM THE POWER SUPPLIES TO THE LOAD MUST NOT EXCEED 0.25 VOLT PER LEAD (0.5V TOTAL).

3-27 The following example describes the parallel operation of four (4) Model RMK 05—C, for a total output current of 120 Amperes with an operating potential of 5 volts at the load and a total load wire drop of 0.5 volt. The anticipated maximum ambient temperature is 40°C. A short calculation will reveal whether these parameters are within the capabilities of the proposed system:

A) LOAD POWER REQUIRED: 5V x 120 A = 600 WATT

B) LOAD WIRE POWER LOSSES: 0.5V x 120 A = 60 WATT

Total = 660 WATT

C) ONE RMK 05—C MUST SUPPLY 660/4 = 165 WATT AT 40°C.

D) A CHECK WITH THE RATING TABLE (SECTION I, TABLE 1-1) SHOWS THAT THIS IS WITHIN THE SAFE OPERATING REGION OF THE RMK MODEL (TABLE VALUE @ 40°C = 5V x 38A = 190W).

3-28 The power supplies are rack-mounted as shown in FIG. 3-8 and are, therefore, physically close together. To inter-connect the output terminals and the load, heavy copper bus-bars are used, to keep voltage drops to a minimum. Wire gage for the error sensing leads and the input source wiring are noted in the set-up diagram FIG. 3-8).

3-29 PROCEDURE, MULTIPLE PARALLEL CONNECTION OF RMK POWER SUPPLIES

Note: ***Before*** connecting the RMK supplies to the parallel set-up, turn supplies "on" individually and set their operating controls as follows:

RMK CONTROL	CONTROL-SETTING (ALL SUPPLIES)
V.ADJ.	5.1 VOLT
O.C.	34.5 A (115% OF RATED CURRENT AT 50°C. THIS IS THE STANDARD FACTORY SETTING).
O.V.	MAXIMUM CLOCKWISE = APPROX. 6V. THIS SETTING WILL STILL PROVIDE OVERVOLTAGE PROTECTION AND AT THE SAME TIME PREVENT FALSE TRIGGERING OF THE OVERVOLTAGE PROTECTOR.

STEP 1) Connect RMK supplies as shown in FIG. 3-8.

Note: Leave the (-) bus from Supply #4 to the load open and connect an accurate d-c ammeter of suitable range between the (-) bus and the load (M2 in FIG. 3-8). Monitor output voltage with a digital voltmeter (M1 in FIG. 3-8).

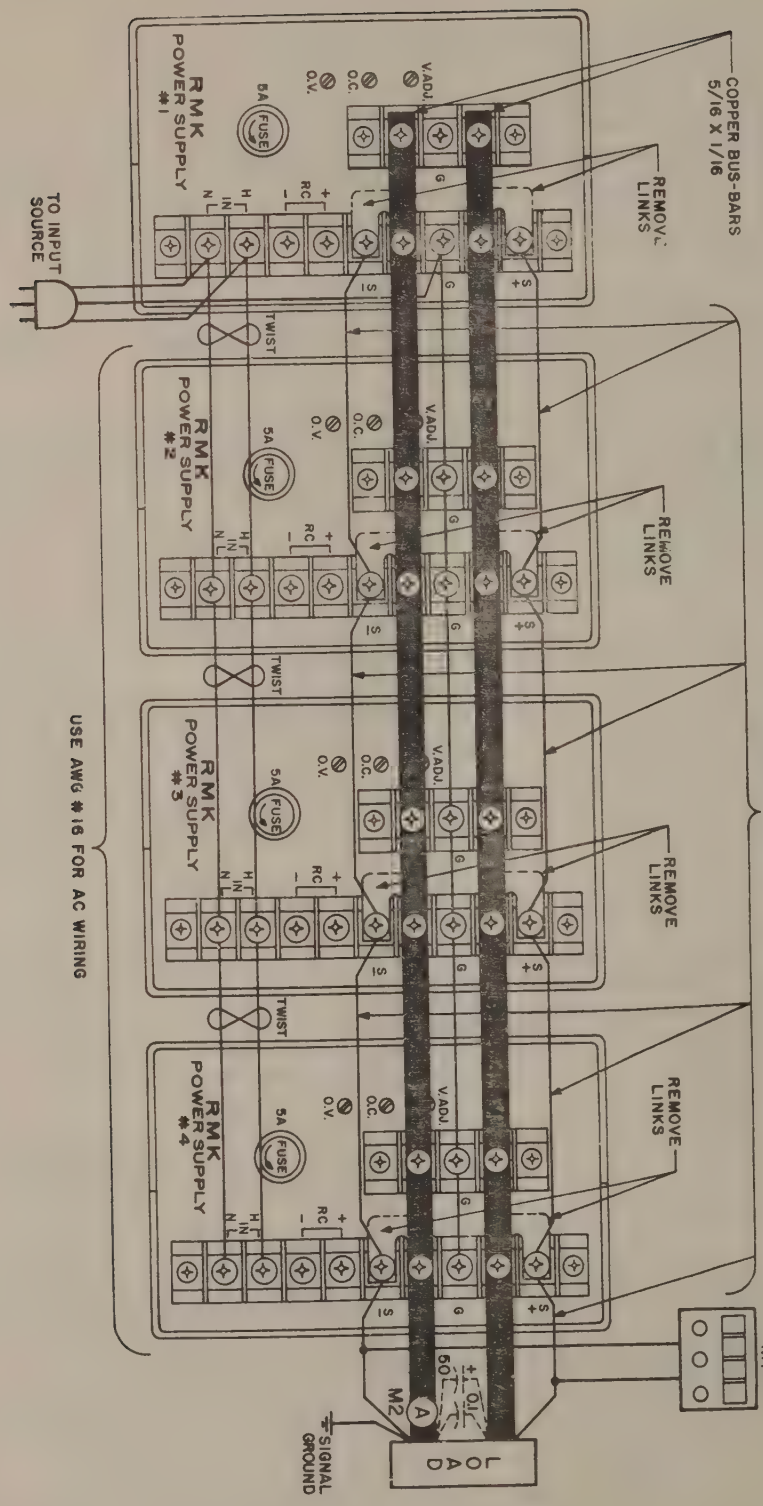


FIG. 3-8 FOUR (4) RMK POWER SUPPLIES CONNECTED IN PARALLEL.

STEP 2) Turn power supply system "on" and monitor load voltage and current as indicated in FIG. 3-8.

STEP 3) With a suitable screwdriver, slowly turn V.ADJ. control of Supply #1 counterclockwise until 5.00 volts is read out on M1.

STEP 4) Turn V.ADJ. of Supply #2 slowly counterclockwise until it takes control from Supply #1 as indicated by the voltmeter reading on M1. Turn V.ADJ. to approximately 4.90 volts and then slowly approach 5.00 volts until Supply #2 just reaches 5.00 volts.

STEP 5) Repeat the process described in Step #4 for Supply #3 and then for Supply #4 until all supplies are operating close to the required load voltage. This concludes the adjustment.

Note: Careful adjustment of the output voltage of all supplies will result in equal current sharing and yield load effects close to that of a single unit. A carefully adjusted system should yield output voltage changes for full load to no load of approximately 60 mV.

3-30 INTERNAL CONTROLS OF THE RMK POWER SUPPLY AND THEIR ADJUSTMENT

3-31 Three recessed, screwdriver adjustable controls have been provided on the RMK power supply. They are clearly marked on each RMK model as follows: (Refer to FIG. 3-9, for example):

V.ADJ. = Output Voltage Adjustment
O.C. = Current Limit Point Calibration
O.V. = Overvoltage Limit Point Calibration

3-32 These controls are factory set to the nominal values, given in Table 3-1. The "V.ADJ." (OUTPUT VOLTAGE ADJUSTMENT) may be set to any value within the given output voltage range. The "OV" adjustment can be set approximately ±5% around the overvoltage limit point given in Table 3-1, thus either increasing or decreasing the threshold of the overvoltage protector.

THE OUTPUT CURRENT LIMIT CONTROL (O.C.) ON EACH RMK MODEL IS SET TO APPRXIMATELY 115% OF THE 50°C RATING IN TABLE 1-1, SECTION I. IT MAY BE RESET TO THE HIGHER OUTPUT CURRENT VALUES, AS LISTED IN THE 40°C AND 30°C COLUMNS OF TABLE 1-1, BY FOLLOWING THE PROCEDURE GIVEN IN THE FOLLOWING PARAGRAPHS.

NOTE: To reset any control, the locking paint around the control slot must be carefully removed by means of a needle, or other pointed instrument. DO NOT RESET ANY CONTROL BEYOND THE VALUES GIVEN IN SECTION I, TABLE 1-1 OR IN TABLE 3-1. ALTHOUGH THIS MAY BE POSSIBLE (DUE TO COMPONENT TOLERANCES), POWER SUPPLY DAMAGE MAY RESULT. Instructions for setting the output voltage, the current limt and the overvoltage limit point are given in the following paragraphs.

RMK MODEL NOM. OUTPUT VOLTAGE	APPROXIMATE OUTPUT - VOLTAGE RANGE (V.ADJ.) MIN	NOM	MAX	CURRENT - LIMIT POINT (O.C.)	OVERVOLTAGE LIMIT POINT (O.C.)
5V	3.5V	5V	5.5V	SET TO THE 50°C	6V
9V	6.3V	9V	9.9V	VALUE AS LISTED	10.5V
12V	8.4V	12V	13.2V	FOR EACH MODEL	14V
15V	10.5V	15V	16.5V	IN SECTION I,	17V
24V	16.8V	24V	26.4V	TABLE 1-1.	27V
28V	19.6V	28V	30.8V		33V

TABLE 3-1 INTERNAL CONTROL SET POINTS FOR ALL RMK MODELS.

OUTPUT VOLTAGE ADJUSTMENT **(V.ADJ.)**

A) Monitoring the RMK output voltage at the output terminals with an accurate voltmeter, (M1 in FIG. 3-9, set the "V.ADJ." control to the desired value. (Refer to FIG. 3-9).

3-33 CURRENT LIMIT ADJUSTMENT **(O.C.)**

A) Set up the test circuit shown in FIG. 3-9. Close switch S1.

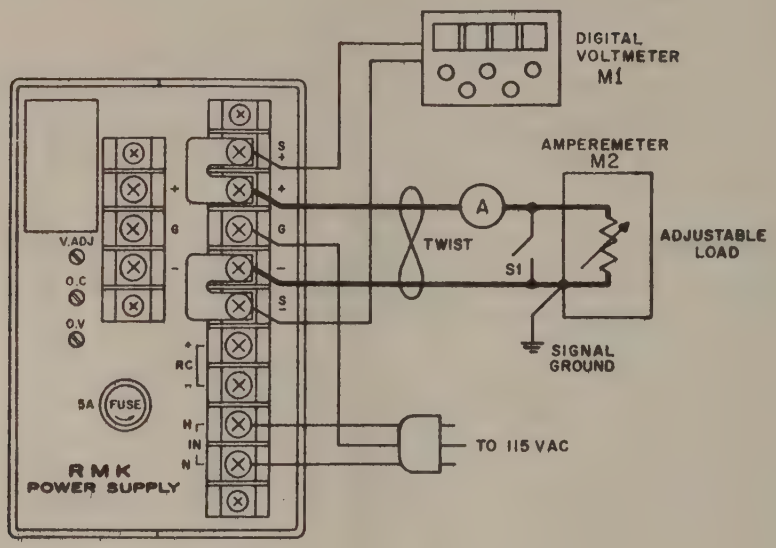


FIG. 3-9 TEST SET-UP FOR CURRENT LIMIT AND OVERVOLTAGE ADJUSTMENTS.

B) Turn "O.C." Control to its maximum counterclockwise position. Turn A-C power "on". The d-c current read-out on M2 is the short-circuit current of the RMK under test. Adjust this current by turning the "O.C." control to your required load current value plus 15%. Set LOAD to its maximum resistance value and open S1.

C) Check the current limit point by adjusting the load from its maximum resistance (minimum current) toward a value yielding the required operating current. Decrease the load resistance further, monitoring M1 and M2. The output voltage should start to decrease at the adjusted current limit point, approximately 15% beyond the desired operating current.

3-39 OVERVOLTAGE ADJUSTMENT **(O.V.)**

A) Use the test set-up shown in FIG. 3-9, but ***without*** connecting the LOAD.

B) Turn the O.V. Control to its maximum ***clockwise*** position. Turn a-c power "on" and adjust the VOLTAGE CONTROL ADJUSTMENT (V.ADJ.) to the desired ***overvoltage limit point.***

C) Turn O.V. control slowly ***counterclockwise,*** until the VOLTMETER READING GOES TO ZERO.

Note: Following the shut-down of the power supply by means of the overvoltage protector, the input source power to the RMK power supply must be interrupted for 5 to 10 seconds, to reset the protective circuit.

D) Reset the V.ADJ. control to the desired ***output voltage level.*** The smallest possible "threshold" (difference between ***overvoltage adjustment level*** and ***output voltage level*** is approximately 0.5 volts.

SECTION IV – ELECTRICAL PARTS LIST AND DIAGRAMS

4-1 GENERAL

4-2 This section contains the main schematic, the parts location diagrams, and a list of all replaceable electrical parts. All components are listed in alpha-numerical order of their reference designations. Consult your Kepco Representative for replacement of parts not listed here.

4-3 ORDERING INFORMATION

4-4 To order a replacement part or to inquire about parts not listed in the parts list, address order or inquiry either to your authorized Kepco Sales Representative or to:

KEPCO, INC.
131–38 Sanford Avenue
Flushing, N.Y. 11352

4-5 Specify the following information for each part:

a) Model and complete serial number of instrument.
b) Kepco part number.
c) Circuit reference designator.
d) Description.

4-6 To order a part not listed in the parts list, give a complete description and include its function and location.

ABBREVIATIONS USED IN KEPCO PARTS LISTS

A) Reference Designators:

A = Assembly
B = Blower (Fan)
C = Capacitor
CB = Circuit Breaker
CR = Diode
DS = Device, Signaling (Lamp)
F = Fuse
FX = Fuse Holder
IC = Integrated Circuit
J = Jack
K = Relay
L = Inductor
LC = Light-Coupled Device
M = Meter
P = Plug
Q = Transistor
R = Resistor
S = Switch
T = Transformer
TB = Terminal Block
V = Vacuum Tube
X = Socket

B) Description Abbreviations

A = Ampere
AC = Alternating Current
AMP = Amplifier
AX = Axial
CAP. = Capacitor
CER = Ceramic
CT = Center-Tap
°C = Degree Centigrade
FXD = Fixed
Ge = Germanium
H = Henry
Hz = Hertz
IC = Integrated Circuit
K = Kilo (10^3)
m = Milli (10^{-3})
M = Mega
MFR = Manufacturer
MET. = Metal
n = Nano (10^{-9})
NC = Normally Closed
NO = Normally Open
P = Pico (10^{-12})
PC = Printed Circuit
POT = Potentiometer
PIV = Peak Inverse Voltage
p-p = Peak to Peak
ppm = Parts Per Million
PWR = Power
DC = Direct Current
DPDT = Double Pole, Double Throw
DPST = Double Pole, Single Throw
ELECT = Electrolytic
F = Farad
FILM = Polyester Film
FLAM = Flammable
°F = Degree Farenheit
RAD = Radial
RECT = Rectifier
REG = Regulated
RECY = Recovery
RES = Resistor
RMS = Root Mean Square
Si = Silicone
S-End = Single Ended
SPDT = Single Pole, Double Throw
SPST = Single Pole, Single Throw
TAN = Tantalum
TSTR = Transistor
u = Micro (u) (10^{-6})
VAR = Variable
V = Volt
W = Watt
W.W. = Wire Wound

MODEL RMK–A GROUP **COMMON PARTS LIST** **Code 120779**

REFERENCE DESIGNATION	QTY.	DESCRIPTION	MFRS. NAME & PART NO. SEE BOTTOM NOTE	KEPCO PART NO.	REC. SPARE PART QTY.
C1,2	2	Cap., Polyester, Rad. Leads 0.01uF, 10%, 600V	Matsushita ECQ-F6103KZ	517-0166	1
C3,4	2	Cap., Polyester, Rad. Leads 2200pF, 10%, 50V	Matsushita ECQ-M05222KZ	517-0032	1
C5,6,10, 16,27	5	Cap., Ceramic Disc 0.047uF, +80 -20%, 50V	TDK SC45F1H473Z	517-0096	1
C7,15,41	3	Cap., Polyester, Rad. Leads 1000pF, 10%, 50V	Matsushita ECQ-M05102KZ	517-0005	1
C8	1	Cap., Ceramic Disc 100pF, 10%, 50V	TDK CC45SL1H101KY	517-0046	1
C9	1	Cap., Polyester, Rad. Leads 0.01uF, 10%, 50V	Matsushita ECQ-M05103KZ	517-0003	1
C11	1	Cap., Ceramic Disc 470pF, 10%, 50V	TDK CK45B1H471KY	517-0024	1
C12	1	Cap., Radial Leads 0.01uF, 10%, 630V	Nichicon TDXM-2J103K	517-0050	1
C17,18, 19,20	4	Cap., Met. Film, Ax. Leads 0.047uF, 10%, 200V	Nittuko MDI-2J473M	517-0018	1
C21	1	Cap., Elect., Ax. Leads 220uF, -10%, +100%, 200V	Nippon Chemi-Con SL200T-220	517-0011	1
C22,24,26	3	Cap., Elect., S-End Leads 33uF, 20%, 16V	Nippon Chemi-Con KX16VB-33	517-0123	2
C23,25	2	Cap., Elect., S-End Leads 100uF, 20%, 25V	Nippon Chemi-Con KX25VB-100	517-0144	1
C34	1	Cap., Mica, Rad.Leads 470pF, 20%, 600V	Matsushita DM15C471K5	517-0030	1
C35	1	Cap., Film, Rad. Leads 0.15uF, 10%, 250V	Nichicon TDMX-2E154K	517-0051	1
C36	1	Cap., Elect., S.E. Leads 47uF, 20%, 10V	Nippon Chemi-Con KX10VB-47	517-0174	1
C39	1	Cap., Met. Film, Rad. Leads 0.1uF, 10%, 250V	Matsushita ECQ-E2104KS	517-0208	1
C40	1	Cap., Ceramic Disc 0.1uF, 10%, 50V	TDK SC45F1H104Z	517-0121	1
CR1	1	Rectifier, Bridge 400V (PIV), 4A	Shindengen S4VB40	524-0014	1
CR2,3,6,7, 8,9,10,11, 12,30,31,37, 38,39,40	15	Diode, Switching, Ax. Leads 50V (PIV), 0.2A, 500mW	NEC 1S954	524-0008	2
CR4,5,14,16	4	Diode, Switching, Ax. Leads	NEC 1S2674	524-0013	1
CR19,23,27	3	Diode, Zener, Ax. Leads 5.6V, 3%, 400mW	NEC RD5.6E ± 3%	521-0004	1
CR20	1	Diode, Zener, Ax. Leads 100V, 10%, 400mW	NEC RD100E (B)	521-0072	1
CR21	1	Diode, Zener, Ax. Leads 12V, 11.4-12.6V, 1W	NEC RD12 F(B)	521-0053	1

NOTE: REPLACEMENT PARTS MAY BE ORDERED FROM KEPCO, INC. ORDERS SHOULD INCLUDE KEPCO PART NUMBER AND DESCRIPTION.

PLEASE NOTE: THE MANUFACTURER'S NAME AND PART NUMBER LISTED FOR EACH ITEM ON REPLACEMENT PARTS LISTS REPRESENTS AT LEAST ONE SOURCE FOR THAT ITEM AND IS LISTED SOLELY FOR THE CONVENIENCE OF KEPCO EQUIPMENT OWNERS IN OBTAINING REPLACEMENT PARTS LOCALLY. WE RESERVE THE RIGHT TO USE EQUIVALENT ITEMS FROM ALTERNATE SOURCES. KEPCO, INC.

MODEL RMK –A GROUP **COMMON PARTS LIST** **Code 120779**

REFERENCE DESIGNATION	QTY.	DESCRIPTION	MFRS. NAME & PART NO. SEE BOTTOM NOTE	KEPCO PART NO.	REC. SPARE PART QTY.
CR22	1	Diode, Zener, Ax. Leads 5.1V, 2%, 400mW	NEC RD5.1E ± 2%	521-0012	1
CR25	1	Diode, Zener, Ax. Leads 4.3V, 3%, 400mW	NEC RD4.3E ± 3%	521-0013	1
CR26	1	Diode, Zener, Ax. Leads 4.5-5V, 1W	Fujidenki EQB01-05	521-0015	1
CR32	1	Diode, Zener, Ax. Leads 75V, 10%, 400mW	NEC RD75E (B)	521-0073	1
CR33	1	Thyristor, SCR 200V, 5A	NEC 5P2M	524-0017	1
CR34	1	Diode, Zener, Ax. Leads 20V, 5%, 1W	NEC RD20F (B)	521-0041	1
CR35	1	Diode, Avalanche, Ax. Leads 250-300V (V_{RM}), 0.5A	Fujidenki ERA01-02	521-0046	1
CR36	1	Diode, Zener, Ax. Leads 3V, 3%, 0.5W	NEC RD3.0E ± 3%	521-0021	1
F1	1	Fuse, Fast Blow Type 4A, 250V	Bussman Type MTH	541-0024	5
F1X	1	Fuse Holder	H. Schurter A. G. Type FEU or FER	546-0005	0
IC1	1	IC, Timer (555 Type) 8P-Dual In-Line	Signetics NE 555N-S	550-0001	1
IC2		IC, Quad 2-Input NAND 14 Pin Dual In-Line	Texas Instruments SN7403N	550-0007	1
IC3,4	2	IC, Comparator Amp 8 Pin Dual In-Line	Texas Instruments TL810CP	550-0004	1
L1	1	Input Filter Choke	TDK LF022UL	500-0279	1
Q1	1	Transistor, Si, NPN Power, Flat-Pack	Sanken 2SC2023	519-0009	1
Q3,4,6,9,10	5	Transistor, Si, NPN Small Signal, 2-5B	Toshiba 2SC735	519-0008	1
Q5	1	Transistor, Si, NPN Small Signal, 2-5B	Toshiba 2SA562	519-0006	1
Q7	1	Transistor, Si, NPN Low-Power, TO-92B	Matsushita 2SC1384R	519-0024	1
Q8	1	Transistor, Si, NPN Power, Switch, TO-66	NEC 2SC1865	519-0004	1
R1	1	Res., Power, Fusible, W.W. 10 ohm, 10%, 5W	Matsushita ERF-5AJ100	515-0059	3
R2	1	Resistor, Carbon Film 100k ohm, 5%, 1/4W	KOA RDF25S104J	515-0380	1
R3,17,21,23, 28,38,44,45, 52,61,67	11	Resistor, Carbon Film, F.P. 1k ohm, 5%, 1/4W	KOA RDF25S102J	515-0322	2

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MODEL RMK–A GROUP **COMMON PARTS LIST** **Code 120779**

REFERENCE DESIGNATION	QTY.	DESCRIPTION	MFRS. NAME & PART NO. SEE BOTTOM NOTE	KEPCO PART NO.	REC. SPARE PART QTY.
R4,13,22,70	4	Resistor, Carbon Film 4.7k, 5%, 1/4W	KOA RDF25S472J	515-0328	1
R5	1	Resistor, Carbon Film 6.8 ohm, 5%, 1/4W	KOA RDF25S6R8J	515-0381	1
R6	1	Resistor, Carbon Film 470 ohm, 5%, 1/4W	KOA RDF25S471J	515-0352	1
R7	1	Resistor, Metal Oxide 27 ohm, 5%, 1W	KOA RSF1BJ270	515-0283	1
R8	1	Resistor, Metal Oxide 120 ohm, 5%, 1W	KOA RSF1BJ121	515-0284	1
R9,20,29	3	Resistor, Carbon Film 220 ohm, 5%, 1/4W	Matsushita ERD-25TJ221	515-0051	1
R11	1	Resistor, Carbon Film 15k ohm, 5%, 1/4W	Matsushita ERD-25TJ153	515-0108	1
R12	1	Resistor, Carbon Film 12k ohm, 5%, 1/4W	Matsushita ERD-25TJ123	515-0054	1
R14	1	Resistor, Carbon Film 3.3k ohm, 5%, 1/4W	Matsushita ERD-25TJ332	515-0047	1
R15,65,72	3	Resistor, Carbon Film 2.2k ohm, 5%, 1/4W	Matsushita ERD-25TJ222	515-0046	1
R16,26,68, 69,71	5	Resistor, Carbon Film 10k ohm, 5%, 1/4W	Matushita ERD-25TJ103	515-0055	1
R19	1	Resistor, Carbon Film 680 ohm, 5%, 1/4W	Matsushita ERD-25TJ681	515-0073	1
R24,30	2	Resistor, Carbon Film 100 ohm, 5%, 1/4W	Matsushita ERD-25TJ101	515-0064	1
R27	1	Resistor, Carbon Film 47k ohm, 5%, 1/4W	Matsushita ERD-25TJ473	515-0102	1
R31	1	Resistor, Carbon Film 33 ohm, 5%, 1/4W	Matsushita ERD-25TJ330	515-0114	1
R33,34	2	Resistor, Carbon Film 560 ohm, 5%, 1/4W	Matsushita ERD-25TJ561	515-0087	1
R35	1	Resistor, Carbon Film 390 ohm, 5%, 1/4W	Matsushita ERD-25TJ391	515-0044	1
R36	1	Resistor, Fxd, Carbon Film 820 ohm, 5%, 0.25W	Matsushita ERD-25TJ821	515-0104	1
R37	1	Resistor, Carbon Film 270 ohm, 5%, 1/4W	Matsushita ERD-25TJ271	515-0065	1
R39	1	Resistor, Carbon Film 6.8 ohm, 5%, 1/2W	KOA RDF5096R8J	515-0382	1
R40	1	Resistor, Carbon Film 47 ohm, 5%, 1/4W	Matsushita ERD-25TJ470	515-0086	1
R47	1	Resistor, Metal Film 1k ohm, 5%, 1/4W	Nikkohm RN131F102	515-0181	1

NOTE: REPLACEMENT PARTS MAY BE ORDERED FROM KEPCO, INC. ORDERS SHOULD INCLUDE KEPCO PART NUMBER AND DESCRIPTION.

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KEPCO, REPLACEMENT PARTS LIST

MODEL RMK-A GROUP COMMON PARTS LIST Code 120779A

REFERENCE DESIGNATION	QTY	DESCRIPTION	MFRS. NAME & PART NO. SEE BOTTOM NOTE	KEPCO PART NO.	REC. SPARE PART QTY.
R48,49,63	3	Resistor, Carbon Film	Matsushita	515-0093	
R50	1	Resistor, Carbon Film	Matsushita	515-0101	1
R54,56	2	Resistor, Variable, Trim	Copal Electronics	515-0007	1
R55	1	Resistor, Variable, Trim	Copal Electronics	515-0115	1
R60	1	Res., Fxd, Carbon Film	KOA	515-0383	1
R62	1	Res., Fxd, Carbon Film	KOA	515-0388	
R64	1	Res., Fxd, Carbon Film	Matsushita	515-0050	1
R66	1	Res., Fxd, Carbon Film	Matsushita	515-0086	1
T1	1	Transformer, Auxiliary	TDK	500-0280	1
T2	1	Transformer, Driver	TDK	500-0281	
T4	1	Transformer, Current Sensing	TDK	500-0347	

NOTE: REPLACEMENT PARTS MAY BE ORDERED FROM KEPCO. NO. ORDERS SHOULD INCLUDE KEPCO PART NUMBER AND DESCRIPTION.

PLEASE NOTE: THE MANUFACTURER'S NAME AND PART NUMBER LISTED FOR EACH ITEM ON REPLACEMENT PARTS LISTS REPRESENTS AT LEAST ONE SOURCE FOR THAT ITEM AND IS LISTED SOLELY FOR THE CONVENIENCE OF KEPCO EQUIPMENT OWNERS IN OBTAINING REPLACEMENT PARTS LOCALLY. WE RESERVE THE RIGHT TO USE EQUIVALENT ITEMS FROM ALTERNATE SOURCES. KEPCO, INC.

KEPCO. REPLACEMENT PARTS LIST

MODEL RMK 28–A **INDIVIDUAL PARTS LIST** **Code 120779**

REFERENCE DESIGNATION	QTY.	DESCRIPTION	MFRS. NAME & PART NO. SEE BOTTOM NOTE	KEPCO PART NO.	REC. SPARE PART QTY.
C14	1	Cap., Film, Radial Leads 2200pF, 10%, 400V	Matsushita ECQ-M4222KZ	517-0067	1
C28,29,30,31	4	Cap., Elect., S.E. Leads 470uF, 20%, 35V	Nippon Chemi-Con KX35VB-470	517-0124	1
CR24	1	Diode, Zener, Axial Leads 5.6V, 3%, 0.5W	NEC RD5.6E ± 3%	521-0004	1
CR28	1	Diode, Rect., Shottky 300V (PIV), 8A, TO-3	Sanken 10C2S30	524-0028	1
L2	1	Filter Choke, Output	TDK CH064UL	500-0285	1
R18	1	Res., Fxd, Carbon Film 4.7k ohm, 5%, 0.25W	Matsushita ERD-25TJ472	515-0053	1
R41	1	Res., Fxd, Metal Oxide 4.7k ohm, 10%, 2W	KOA RSF-2BJ472	515-0211	1
R42	1	Res., Fxd, Metal Oxide 30 ohm, 5%, 2W	KOA RSF-2BJ300	515-0107	1
R46	1	Res., Fxd, Metal Film 7.5k ohm, 1%, 0.25W	Nikkohm RN131F752	515-0266	1
R51	1	Res., Fxd, Metal Oxide 680 ohm, 5%, 2W	KOA RSF-2BJ681	515-0139	1
T3	1	Transformer, Power	TDK MT143UL	500-0284	1

NOTE: REPLACEMENT PARTS MAY BE ORDERED FROM KEPCO, INC. ORDERS SHOULD INCLUDE KEPCO PART NUMBER AND DESCRIPTION.

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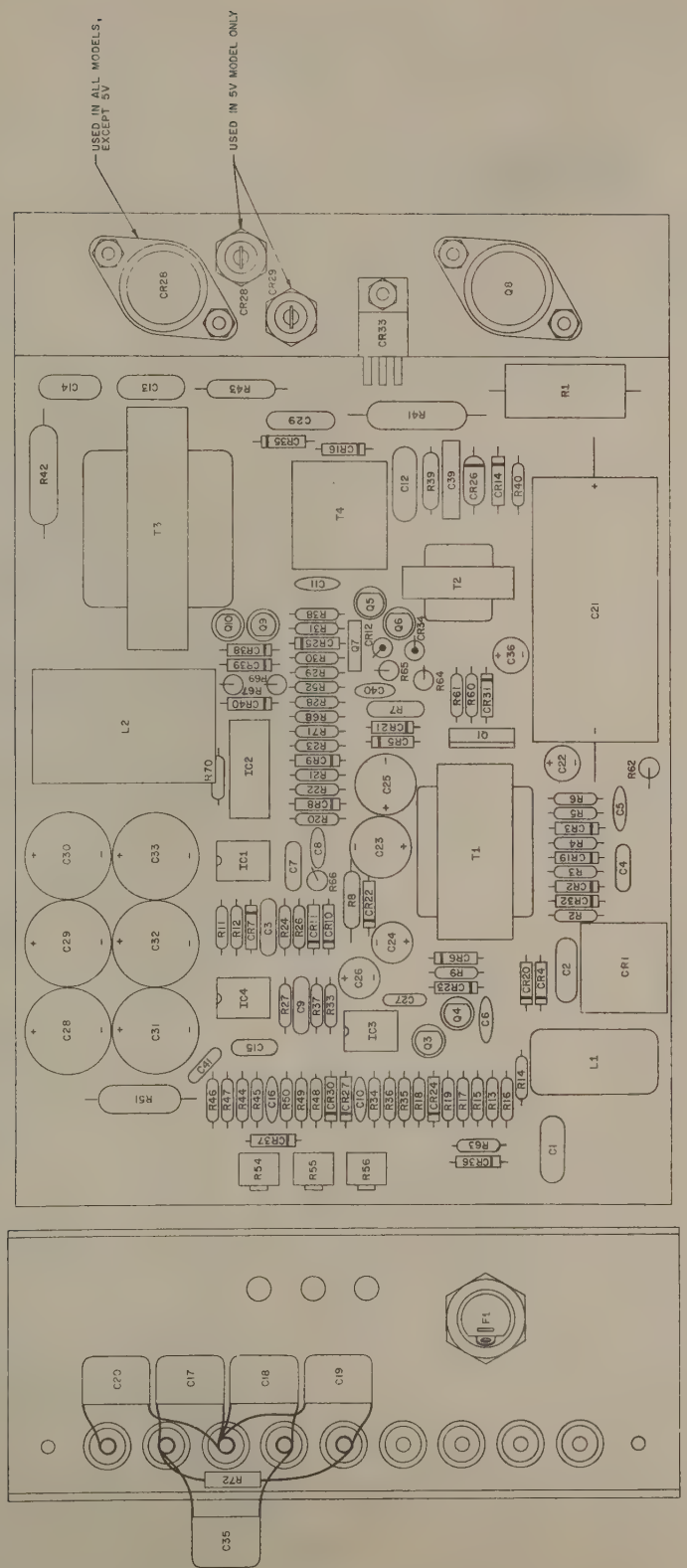
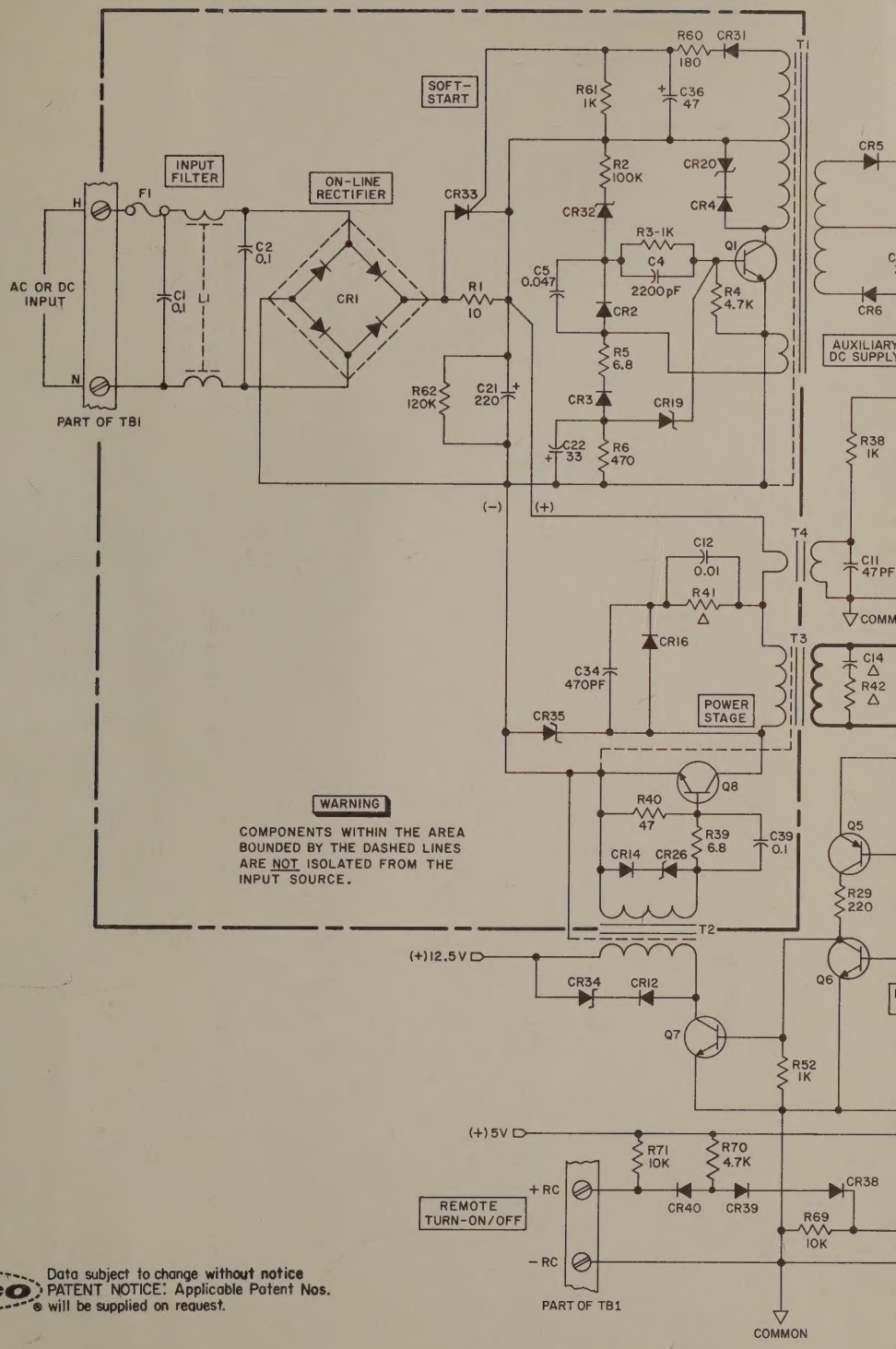


NOTES:
1) NOT ALL COMPONENTS USED IN ALL MODELS, SEE PARTS LIST.
2) DIODES MARKED ⊙ ARE MOUNTED WITH CATHODE UP.

FIG. 4-1 COMPONENT LOCATION, RMK–A (SOFT-START).



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Data subject to change without notice
PATENT NOTICE: Applicable Patent Nos. will be supplied on request.

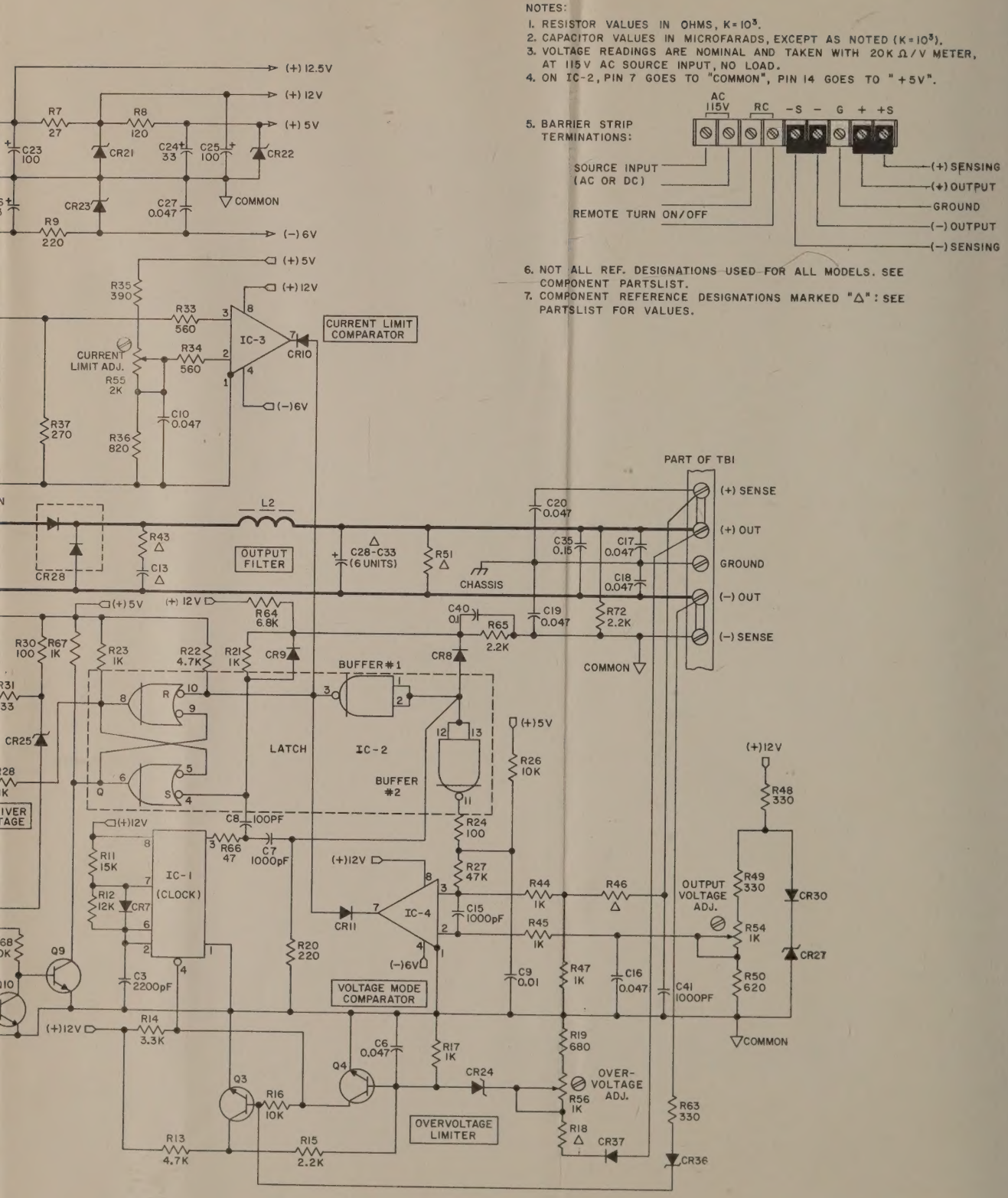
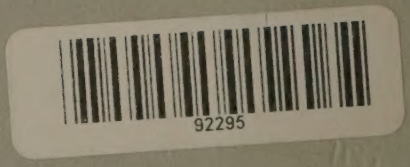


FIG. 4-2 MAIN SCHEMATIC, RMK-A (SOFT-START).



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